PUBLIC WORKS

An Engineering and Construction Journal

City County State

VOL. 61 DECEMBER, 1930 NO. 12

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Plan Now— And Act:

To-day's dollar will buy more in the line of roads, sewers, water supply, and other governmental necessities than at any time in the past 10 or 15 years. Communities have been so starved for extension of these public services by the high money rates of the past few years; so much of the cost of street and road construction, sewers, sewage treatment plants and additional water supply facilities goes into labor; so much of these expenditures can be put into the pockets of home folks by requiring contractors to employ local labor, that it seems to us the plain path of wisdom to bend every effort to inaugurate work along these lines NOW. Planning alone will not be sufficient: Execution must follow directly. If each one does his share, this world will be a better place to live in.

Can We Help?

Public Works is in touch with a number of young engineers who have had special training in sanitary and public health engineering, and who are seeking positions. If anyone has, or knows of, an opening in this line, we should be glad to hear from him. On our part, we promise to check carefully the character and fitness of the aspirants before we loose them on any one.

That Snow Problem

That snow problem thinned out the ranks of contest solvers very materially. There was only one repeater. S. L. Moyer from Montevideo, Minn., came through as No. 2 of the correct solvers again. But not all the solutions were correct. Nearly everyone had his own way of working it; some contented themselves with giving the answer only. Mr. Moyer's solution, which is as clear as any, is given herewith:

Q = Volume of snow at start in man-power minutes.
S = Snow-fall rate in man-power per minute.
t = Minutes required with 4 men.

$Q + 20S = 8 \times 20 = 160$
$Q + 60S = 5 \times 60 = 300$
$40S = 140 \qquad S = 3\frac{1}{2}$
$Q + 20 \times 3.5 = 160$ whence $Q = 90$
$90 + 3.5t = 4t$ and $t = 180$ min or 3 hrs. Ans.

(The problem was: During a heavy storm, a group of men went out to remove the snow from a street. It was found that eight men could clean a block in 20 minutes, while five men needed 60 minutes to clean a block of the same size. Assuming that the rate of work, capabilities of the men, snow, etc., were all uniform throughout the period, how long would it have taken four men to clean a block?)

The holiday season being almost with us, we hereby declare a holiday in the problem line, and wish you all a Merry Christmas and a Happy New Year.

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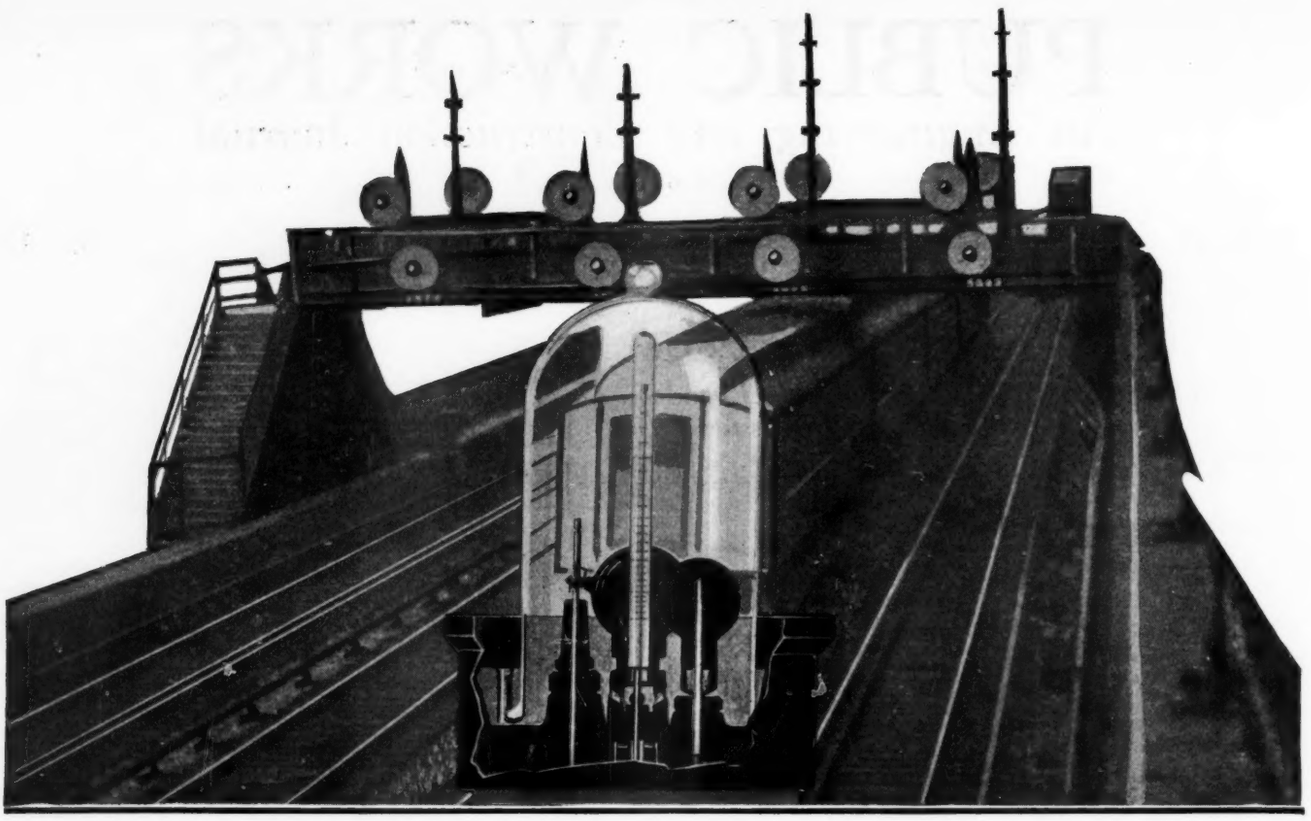
CROXTON MORRIS, *Ass't Manager*

PUBLIC WORKS
Founded in 1896
A. PRESCOTT FOLWELL, *Editor*
Published Monthly
at 310 East 45th St., New York, N. Y.
Western Office: 122 South Michigan Ave., Chicago

S. N. HUME, *Cleveland, Ohio*
F. C. VIGUERIE, *New York, N. Y.*
JOSEPH E. O'CONNOR, *Chicago, Ill.*

SUBSCRIPTION RATES: United States and Possessions, Mexico and Cuba.....$3.00 All other countries....$4.00 Single copies, 35 cts. each.



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The *classified* INDUSTRIAL LITERATURE section is your guide to the latest catalogs—see page 93

PUBLIC WORKS

CITY COUNTY STATE

AN ENGINEERING AND CONSTRUCTION MONTHLY

Vol. 61 December, 1930 No. 12

Refuse Incineration in Several Small Municipalities

Some of less than twenty-five thousand population noted. Details of operation, costs and results of a forty-ton incinerator at Greensburg, Pa.

By Herbert W. Lincoln

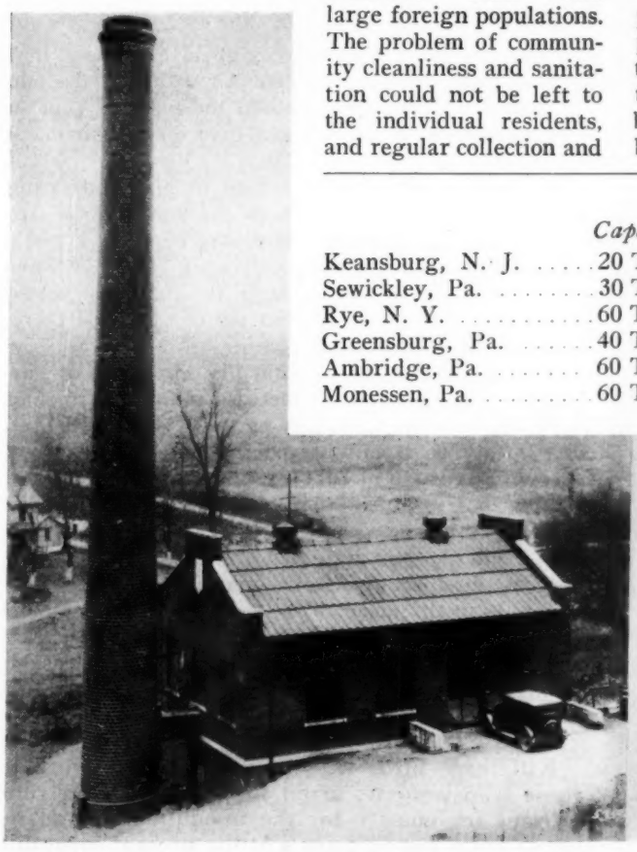
Morse Boulger Destructor Co.

DURING the past ten years quite a number of small municipalities have installed incinerators for destroying garbage and rubbish, most of them also instituting municipal collection as well. Some of those which have practiced this for five years or more are mentioned in the table below.

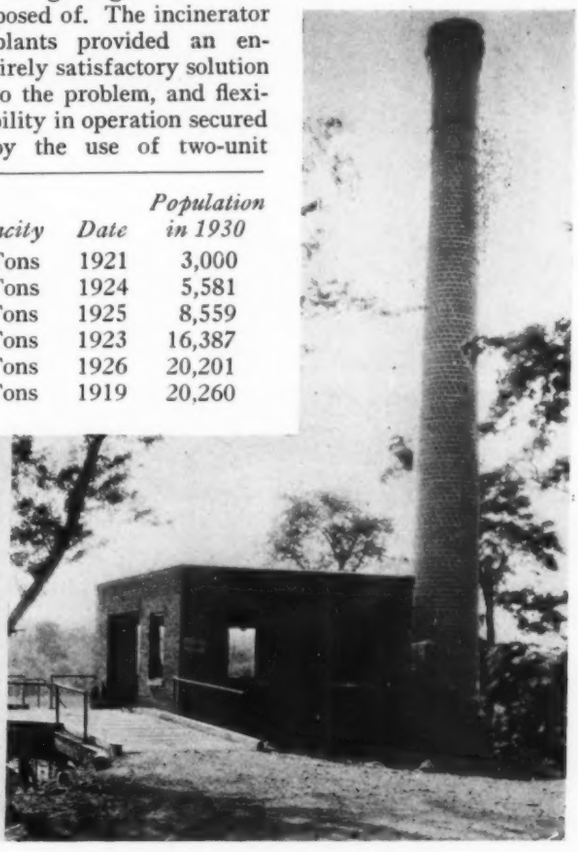
Of these, Ambridge and Monessen are essentially industrial cities with large foreign populations. The problem of community cleanliness and sanitation could not be left to the individual residents, and regular collection and disposal service had to be provided by the municipalities. There has been a very definite improvement in health conditions since the adoption of incineration.

The villages of Keansburg and Rye are seaside villages, having very large increases in population during the summer months. The presence of hotels and amusement parks resulted in a large amount of wet garbage to be disposed of. The incinerator plants provided an entirely satisfactory solution to the problem, and flexibility in operation secured by the use of two-unit

	Capacity	*Date*	*Population in 1930*
Keansburg, N. J.	20 Tons	1921	3,000
Sewickley, Pa.	30 Tons	1924	5,581
Rye, N. Y.	60 Tons	1925	8,559
Greensburg, Pa.	40 Tons	1923	16,387
Ambridge, Pa.	60 Tons	1926	20,201
Monessen, Pa.	60 Tons	1919	20,260



Twenty-ton incinerator at Keansburg



Forty-ton incinerator at Greensburg

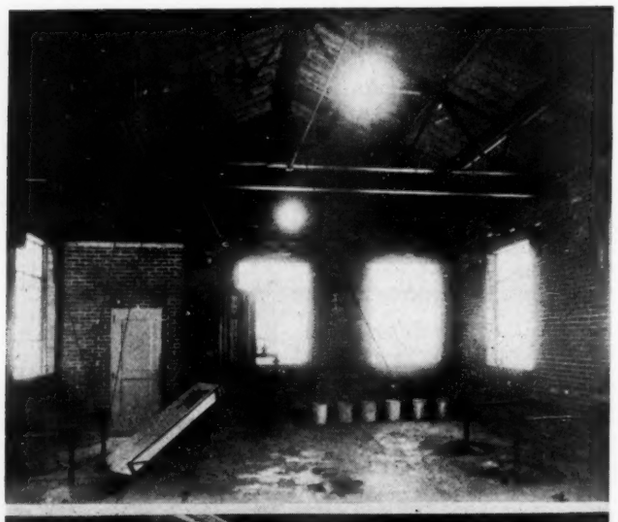
plants resulted in economical operation throughout the year.

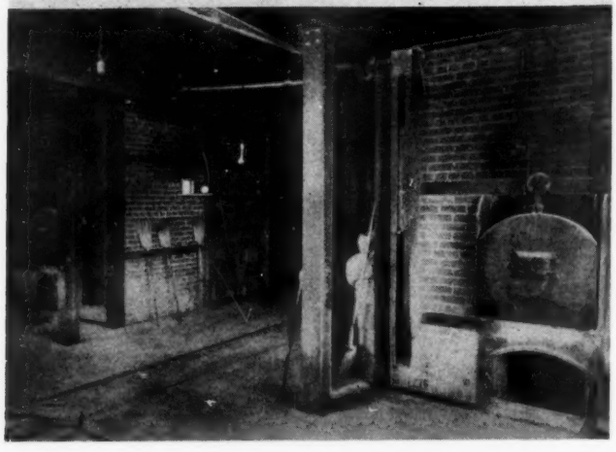
Sewickley is a high-class residential suburb of Pittsburgh. In this borough, all garbage cans are municipally owned, and in the collection service clean, sterilized cans are left wherever a full can is collected. The full cans are then loaded on a truck and taken to the plant, where the garbage is dumped directly into the incinerator, and the cans are sterilized. In this way a complete service is rendered to the residents and the cost has been found to be surprisingly low.

At Greensburg

The city of Greensburg can be considered quite typical of many small cities of 15,000 to 20,000 population in the country. It is an industrial city and also serves as a shopping center for a surrounding agricultural and mining district. It is far enough from any large city so that it must provide complete shopping, banking and amusement service to its citizens.

The collection service is provided by a private contractor who has an exclusive contract for which he pays the city approximately $3,300 per year. No other person may collect garbage or rubbish for pay, although any individual or company may haul their own refuse. A charge of 75c per month is made on each house collected from, and hotels, restaurants, boarding houses, stores and other similar establishments are charged according to the amount of refuse.





Above—Charging floor at Sewickley
Below—Furnaces at Greensburg

The city owns and operates the incinerating plant, the contractor's responsibility ending when the garbage is delivered to the plant. Garbage and rubbish are collected separately and every load is weighed at the plant. The collection system and the plant are under the supervision of a superintendent who spends most of his time inspecting conditions throughout the city. As a result of this supervision, the city truly lives up to his proud boast that it is the cleanest small city in the state.

The labor at the plant consists of two men, who are also charged with the proper maintenance of the adjoining dump on which the ashes are disposed of. Coal is used for providing hot water, and for heating the plant in the winter. It is also used as fuel in the destructors at times when the garbage is very wet, when the proportion of rubbish is low, or when the interval between loads is particularly long.

Following is a tabulation showing the important items concerning refuse delivered and cost of operation:

	1928	1929	1930 (10 months)
Year of plant operation	6th	7th	8th
Tons of refuse delivered	6136	7370	5334
% Garbage	75.5	74.3	82.7
% Rubbish	24.5	25.7	17.3
Dead animals	..	69	71
Total operating cost	$4948.53	$4925.60	$4026.30
Cost per ton of refuse:			
Labor and superintendence	$.783	$.65	$.75
Maintenance, labor and materials	$.00967	$.0085	$.000
Total coal (including heating)	$.0145	$.0085	$.005
Total operating cost	$.80717	$.6670	$.755

Although the maintenance cost is extremely low, representing less than one cent a ton during the 6th, 7th and 8th years of operation, the plant is kept in first class condition and should give service for many decades.

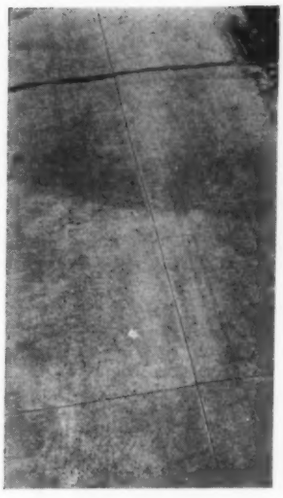
As labor is the principal item in plant operating cost, there is little variation in the annual total cost of operation even though there may be quite a variation in the amount of refuse delivered. In 1929, when the refuse collections were high, the total cost varied little from that for 1928, and the cost per ton therefore decreased appreciably.

It is interesting to note that the proportion of garbage to rubbish shows an increase for the ten months of 1930. This is doubtless partially due to the fact that in the two remaining months there is normally a greater proportion of rubbish than during the summer months, but it probably is also due to the fact that during the business depression, the buying power of the community was decreased and there was less rubbish produced in the stores and in the delivery of materials to the homes.

These small communities have found incineration to be a practical, economical and almost indispensable means of insuring community cleanliness and health.

Kill three birds with one stone: Give work to those who need it; avoid having to call on your citizens for charity for the unemployed; and secure public improvements at the present favorable prices.

Seventy-foot street of finished concrete laid in ten-foot strips with frequent transverse expansion joints. Fifth Ave. at Florida Ave., Washington, D. C.



Crackless concrete on heavy-traffic street, with center joint, transverse expansion joints at 96-foot intervals, with two transverse contraction joints between, and 54 lb. mesh reinforcing.

Present Trends in City Paving

Notable advance in quality of design and care in construction. Increased width. Speed of construction. Improvements in concrete, brick, asphalt and low-cost types.

By James S. Burch, Jr.
Assistant Engineer, American Road Builders' Association

ALTHOUGH city paving for 1930 may not show an increase in volume over other years, there is no doubt that in quality of design and care in construction, city paving departments have continued to advance. This fact was observed in a survey recently made by the American Road Builders' Association.

The State highway departments have made great strides in improving the quality of rural pavements. The research efforts of the United States Bureau of Public Roads, the Highway Research Board, the American Society for Testing Materials and the American Road Builders' Association have resulted in better and more economical construction and maintenance. Compare the pavements of 1918 with those of 1928, and the improvement becomes obvious. This development has been possible through individual and collective study, research effort and experimentation, to the end that paving standards for State highways now represent the best knowledge on the subject.

Many men trained in State highway work have entered city paving departments and have found it beneficial to take advantage of the findings of highway experience and research, and have added to this their own knowledge, to the end that great improvements have been effected. There are, however, a great number of practices followed by many cities which are not generally considered the best, due largely to the continued use of obsolete methods, and the unfortunate fact that many city engineers must be more vitally interested in performing functions which will keep them in good favor politically than in improving the quality of their paving. It is promising, however, to observe the many improvements already accomplished in city paving.

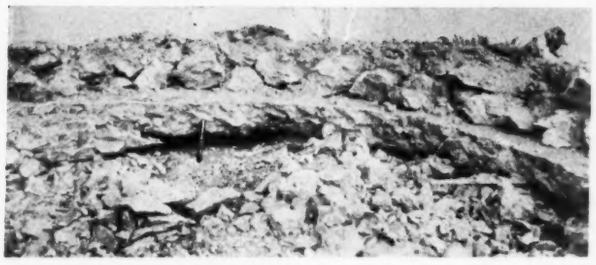
In view of the improved quality of street paving, the lowered costs of construction, the low rate of interest on capital and the need for more improved streets generally, this appears a most opportune time for officials and citizens to join in the general movement for the relief of unemployment by increasing street paving appropriations for 1931. Since over 50% of the highway dollar goes directly to labor and is immediately put into circulation, such a policy would tend to relieve the business depression more rapidly than any other activity involving a like amount of funds.

Increased Width

In built-up downtown areas, it is almost impossible to effect a general widening program economically; but in the suburban and residential areas, and new developments, wider streets have been the order of the day, and whereas several years ago, a 30-foot street was considered ample, many present traffic arteries are built from 50 feet up to even 100 feet from curb to curb. Cities have in many cases conducted traffic surveys and used these as a basis for widening. Almost every street carrying even a minimum number of vehicles per day is now being paved, whereas several years ago only important streets were considered for such improvements.

Speed of Construction

Property owners and motorists each year demand more and more speed in street construction, feeling that one week or less should be sufficient time to keep a block closed. This has required more adequate planning, co-ordination of public utilities, and has stimulated the increased use of power shovels, fast trucks, pneumatic tools, ditchers, backfillers, mechani-



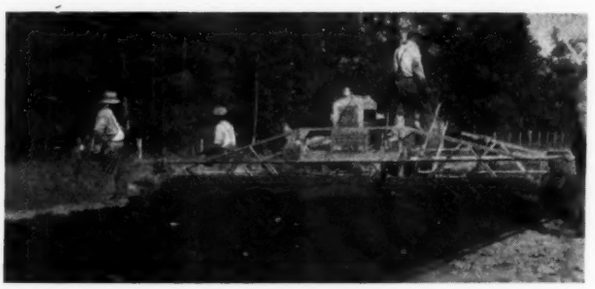
Failure in plain 6-inch concrete due to lack of compaction of subgrade prior to paving and failure to avoid subgrade erosion

cal tampers, weight-proportioning equipment, ready mixed concrete, high early-strength cement and concrete, light weight reinforcing, mechanical finishers and curing mediums. Also we observe that many cities open streets when the concrete has *actually* obtained sufficient strength rather than at some arbitrary date. Through the use of such methods and equipment, together with half-at-a-time construction, streets may now be closed to traffic only a few days, rather than weeks as was the custom several years ago.

Subgrade Study

The effect of subgrade soils and conditions has long been recognized, and has been studied carefully within the last few years by research agencies and many important facts have been established; and although we cannot as yet use subgrade data as a definite mathematical basis for pavement design, we can take advantage of the knowledge developed and use it for more rational design practice. Apparently only a very few city engineers, however, have given much thought or effort to the solution of this problem. Although it is known that the service and life of a pavement depend to a great extent on the subgrade on which it rests, few engineers, in their design, use any additional factor of safety in pavements on undesirable subgrades, or, on the other hand, take advantage of good subgrade conditions, but it is the too-common custom to build the same type and strength of pavement, regardless of subgrade conditions.

The use of sub-bases of cinders, sand, gravel, etc., has not grown, but the use of granulated slag on plastic subgrades seems to have increased slightly. Stone sub-bases are more general in New England cities than elsewhere. There is a trend toward the use of lighter subgrade rollers, as compared to the usual requirements of a few years ago, which specified that from 12 to 15-ton rollers be used. The practice of pressure-jetting of embankments and trench backfills has grown to a large extent within the last few years.



Using mechanical finisher on hot asphalt street surface in city park

Comparison of Types

The bituminous wearing surface remains the prevailing type used in city street paving. The Asphalt Institute reports that in large cities east of the Rockies in 1929, asphaltic and bituminous types represented about 76% of the modern standard types built or resurfaced. About the same proportion was indicated for 1930 for cities in this area.

Within the past few years concrete pavements have shown an increase in use in cities, especially in residential and suburban areas and in the paving of alleys. On January first of 1930, there were in all cities of

Low-cost bituminous mixed-in-place surfacing on a suburban street

the United States 20,547 miles of concrete streets on a basis of 30-foot width, according to the Portland Cement Association, such streets being built at the rate of somewhat over 2,400 miles per year for several years.

(Continue on page 72)

Eat Your Cake and Have It Too

Put wages for work on public improvements into your taxpayers' pockets and have the improvements too.

Eight-inch ready mixed concrete base on 60-foot street in Kansas City, finished by screed from forms 20 feet apart

Recent Developments in Chlorination*

Latest theories as to action of chlorine on bacteria. Importance of thorough distribution. Deferring action by formation of chloramines. Alkalinity desirable.

By Francis D. West
Manager of Sales, Paradon Manufacturing Company

The writer of this paper was an early experimenter in the chlorinating of water. In 1909, at the Torresdale filter plant, Philadelphia, Pa., he as chemist, with Joseph Siddons, plant superintendent, endeavored to sterilize raw Delaware river water as applied to one of 120 preliminary or roughing filters, using an ordinary (and very inefficient) laundry cell to generate sodium hypochlorite and applying it to the influent of the filter. After experimenting for about three months, the plan was abandoned—the tools were too crude. There has been great development in the use of chlorine since then, the latest and most important of which are described in this paper.

THERE appear to be three theories as to action of chlorine on bacteria. The first to be advanced was the nascent oxygen theory—that bacteria are destroyed by oxidation.

Next it was suggested that hypochlorites are directly toxic to micro-organisms—it having been proven conclusively that the nascent oxygen theory can account for only a part of the reduction in biochemical oxygen demand. Enslow stated in 1929: "It is evident from the Chicago studies that the reduction in oxygen demand cannot be attributed to the oxidative action of the chlorine. Two parts of chlorine produce but one part of oxygen, whereas the average reduction in oxygen demand at Chicago indicates that one chlorine would have to furnish two oxygen atoms, if the oxidation theory could be applied. In other words, the oxygen demand reduction was four times that theoretically accounted for by the nascent oxygen hypothesis. In all probability the efficacy of chlorination in reducing oxygen demand can best be explained by the known reactions of chlorine on nitrogenous (amido) compounds to produce chloro substitution products—apparently useless as bacterial foods and therefore less putrescible." Enslow also mentions the fact that some of these amido compounds are antiseptics.

As to the third theory, in the book entitled "L'Autojavellisation Imperceptible," Phillipe Bunau-Varilla, speaking of the action of sodium hypochlorite on bacteria, says: "The molecule of hypochlorite of sodium in attacking organic matter must emit rays, the action of which is analogous to ultra violet rays on microscopic life, creating around the scene of chemical action an extended zone of destruction of this microscopic life." He gives the results of several experiments with quartz tubes to prove his theory. He further shows, from his experience, that the sterilizing action of chlorine is greater in the dark.

One thing seems evident, if chlorine can be prevented to any extent from combining chemically with matter other than bacteria, its efficiency as a germicide will be enhanced. Ammonia, properly introduced, seems to be a step in this direction.

It is my conviction that the antisepticizing action of chlorine is the same, pound for pound, whether applied dry in the form of gas, as a solution in water, as a compound with calcium, or sodium as hypochlorites. Everything depends on the thoroughness with which the chlorine is mixed with the water or sewage to be treated; though I will qualify this to a slight degree by stating that the question of alkalinity seems to have some influence, alkaline solutions being apparently more efficient than acid solutions.

The increased efficiency of liquid chlorine in our experiments was due, I am sure, to our ability to diffuse the chlorine through the water being treated in a more thorough manner than was possible with the crude method we had of handling chloride of lime.

Chloride of lime has fallen into dissuse largely due to the difficulties of handling, storing and maintaining the full strength of the chemical. Sodium hypochlorite is used to a greater or lesser extent today, especially for small water supplies, swimming pools, etc. One of the chief objections to its use lies in the fact that at best one can only concentrate it into a solution with about 10 to 12% available chlorine; which solution, if not properly made, breaks down readily and is expensive to transport. The French appear to be using it more extensively than we do.

In the book previously quoted, "L'Autojavellisation Imperceptible," is an account of the use on a large scale of this chemical for the city of Rheims, which claims to be using doses of .1 part per million in place of 1 to 4 parts of chlorine previously used. Bunau-Varilla stated, in part: "Of these infinite doses, nothing portrays to the taste the presence of chlorine and the antiseptices of the water delivered for human consumption is absolute. As a result of our experiments, we state the amount of chlorine taken up by a water containing a definite amount of organic matter varies with the amount of chlorine added."

And, in this connection, I am fortunate in being permitted to present (in advance of their publication by the author, Harry Johnson, chemist in charge of the sewage disposal plant at Flint, Michigan) some studies he has made on what he terms "super-chlorination": "Studies have shown that the amount of residual chlorine carried in a treated water, rather than

(Continued on page 76)

* Slightly condensed from a paper before the New England Water Works Association.

Don't undermine the self-respect of your unemployed by charity—give them work on public improvements.

Street Cleaning in New York Fifty-three Years Ago

THE illustration on the opposite page is interesting from many points of view. Reproduced (reduced one-third) from "Harper's Weekly" for November 24th, 1877, it shows what the best illustrated papers of that day furnished to their readers where they would today use half-tones. To public works officials it is of special interest as showing the equipment and methods employed in street cleaning and refuse removal in New York. Even more enlightening is the article which accompanied the illustrations, which we quote in full below.

The series of sketches on page 925 will give our readers a good idea of the clumsy, expensive, and inefficient method adopted in this city for keeping the streets clean. New York is notoriously one of the least cleanly cities in the civilized world, although an enormous sum is expended every year for the purpose of gathering and removing ashes, garbage, and sweepings from the public thoroughfares. Nearly $1,000,000 is paid annually for half doing a work which, if properly carried on, might be made a source of profit to the city.

The Street-cleaning Bureau employs an army of sweepers and cart-drivers. It is the business of the first, with scrapers and stiff brooms, to collect the refuse of the streets into little heaps, in readiness for the carts, which are started out as soon as darkness sets in and the streets are comparatively free from other vehicles. These carts are intended to carry away not only the sweepings of the "Broom Brigade," but also the collections of garbage, ashes, etc., placed in barrels and boxes before each house. As soon as a cart is filled, the driver takes his way to the "dump" of the district he is at work in, and after having deposited his load, he returns for another. Owing to the neglect of proper supervision, and the carelessness of the men employed in removing house refuse, complaints are constantly made of the indifference shown by the Street-cleaning Department in not removing the garbage, ashes, etc., placed upon the sidewalk for removal by the dwellers. No discipline is maintained; the driver of the dirt wagon goes along removing what he pleases, and neglecting to take any thing that does not suit him. It is also a regular plan for the drivers to start off for the "dumps" when they have only collected half a load, and so shorten their labor for the night. Repeated complaints have also been made as to the system of extortion put in practice by the drivers of the collection carts. "No pay, no removal," seems to be a favorite rule with them. This is particularly the case with hotels, dining-rooms, oyster-houses, and such like establishments, where generally a considerable amount of refuse accumulates daily. As a rule, from twenty-five to fifty cents per day is the amount paid to an accommodating driver. The up-town districts of the city present a marked contrast to the lower districts, where the refuse and garbage are sometimes allowed to collect for days before removal.

There are fourteen public dumps or dépôts for the accumulation of the city's refuse. Of these, five are situated on the North River, at the following points: Forty-sixth Street, Thirty-seventh Street, Twenty-first Street, Twelfth Street, and Laight Street. Nine are situated on the East River, as follows: Eighty-sixth Street, Forty-sixth Street, Thirty-eighth Street, Twenty-second Street, Seventeenth Street, Fifth Street, Stanton Street, Jackson Street, and Market Street. At the foregoing points all the refuse collected is dumped on board scows and barges for removal. These scows and barges are large flat-bottomed boats, as shown in our engraving. When a number of them are loaded, they are towed to the various dumping grounds by steam-tugs, of which there are two constantly in the employment of the Street-cleaning Bureau.

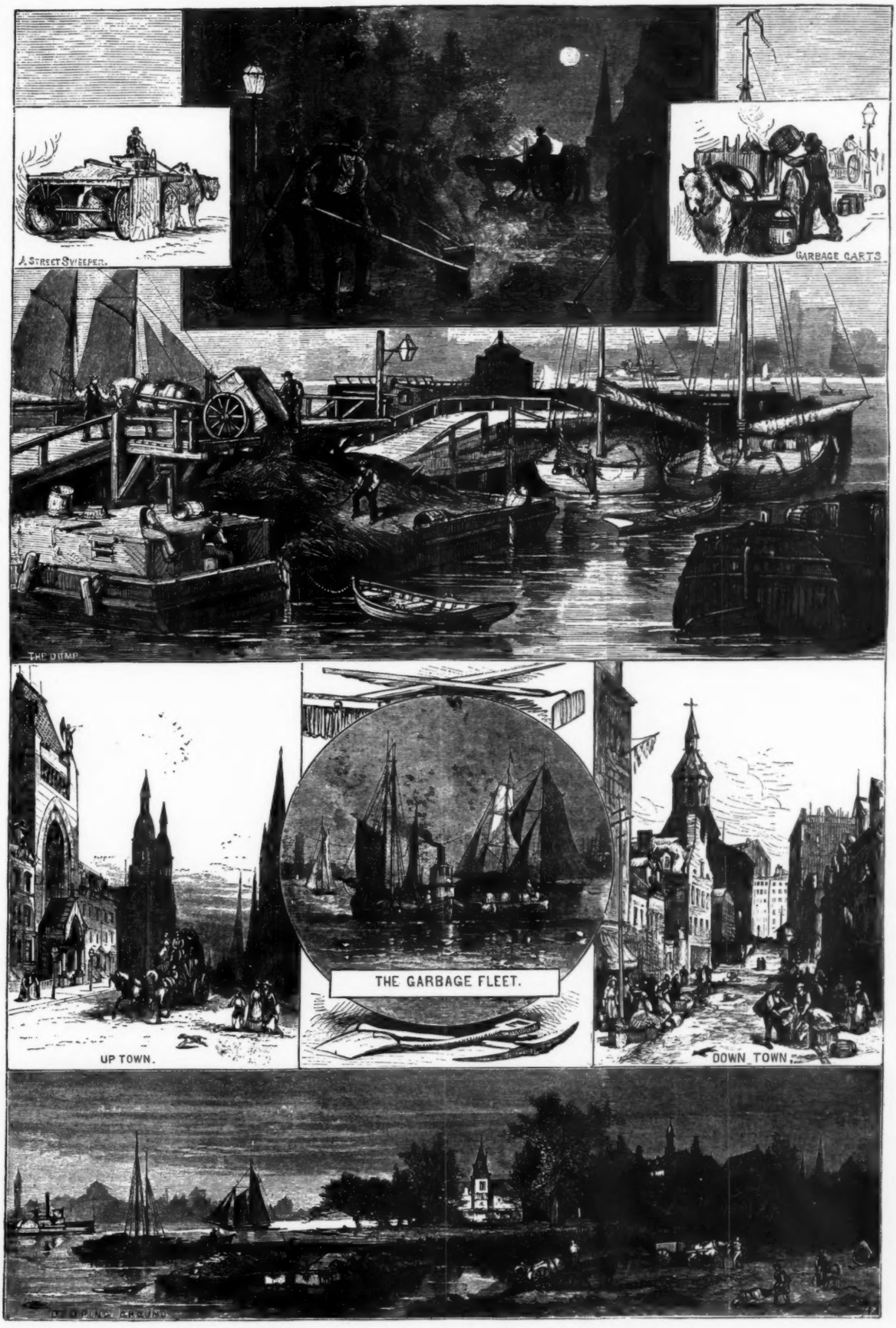
Has your city reached physical perfection? If not, there is work to be done and unemployment is unnecessary.

Great difficulty has been experienced in the selection of proper dumping grounds for the immense amount of garbage and other refuse annually removed from our streets. Wherever deposited, it speedily becomes a nuisance; and the officials in charge of the business have generally shown no regard to public or private interests in their haste to get rid of the accumulation at the least expense and trouble to themselves. Last summer they nearly ruined navigation at the Stepping Stones, in Long Island Sound, destroyed valuable oyster beds in that vicinity, and rendered the shores of Long Island almost uninhabitable, as the tide swept ashore the garbage thrown overboard from the scows. At one time during the early part of the summer the nuisance became so great as to create a panic among the residents and hotel-owners along the Long Island shore, as the many watering-places located there were being deserted, owing to the dangerous and disgusting nuisances created by the police officials in their efforts to get rid of the city's garbage and refuse.

Many other places around the city have suffered from the same cause. Harlem Flats, of which the lower cut on the page will convey a good idea, has been a favorite dumping ground, greatly to the detriment of the public health. Repeated attempts have been made to use the bay as a dumping ground. Owing to the peculiar outline of the Long Island coast, it was impossible to deposit any refuse in the bay without a very large percentage of it being washed ashore on the Coney Island beach. Dead animals, old beds, garbage, and every thing that did not immediately sink were by the action of the tide and winds washed ashore along this line and that of Staten Island, until the nuisance became so great as to demand immediate action on the part of the property-owners along the shore. Within the past two years immense sums of money have been expended in improving Coney Island beach, and with such success that this place has become one of the most popular summer localities within the vicinity of New York. Without warning, a new and peculiar danger threatened the entire place. All kinds of offensive and disgusting filth was washed ashore; dead animals undergoing rapid decomposition, putrid garbage, rotting beds, etc., came gently floating on the tide, rendering it impossible to bathe in this otherwise favorable spot. The prompt and energetic action of the Brooklyn Shore Inspector soon put an end to this gross outrage.

Two plants have been proposed for the disposal of the city refuse—one to burn it in immense furnaces; the other to establish large storage reservoirs, where it can be collected, submitted to the action of disinfecting agents, and allowed to remain until it has undergone the changes necessary to make it available as a fertilizer. The first plan involves waste and expense. By the second, the refuse might be made a source of profit to the city.

Many of these sentences sound very familiar. Dumping of garbage and rubbish still causes pollution of the beaches, only instead of being confined to Coney Island (then just beginning to be a popular resort. When the writer visited it five years before this, there was but one hotel or restaurant there) and Staten Island, the nuisance has spread for nearly a hundred miles east and south. Then, as now, incineration was opposed by non-technical writers attracted by the idea of making the utilizing of refuse a source of income to the city—an ignis fatuus which still eludes capture except perhaps under unusual conditions. The idea of storing the refuse to be worked over into a fertilizer seems to anticipate by about forty years the Beccari system. (See PUBLIC WORKS for June, 1923.)



HOW THE STREETS OF NEW YORK ARE CLEANED.—Drawn by W. P. Snyder.—[See Page 927.]

Reproduced from "Harper's Weekly" for November 24th, 1877.

Water Supply, Sewage Treatment and Refuse Disposal in 1930

A review of the most important developments during the year in these public utilities

By H. Burdett Cleveland*

Interior view of filter house, Nashville water works.

Water Supply

MANAGEMENT and Control.—During 1930 interest has been quickened in the important work undertaken by the Division of Water Works Accounting and Finance, organized at the 1929 summer convention of the American Water Works Association. The close study from a business standpoint to be given to this phase of water works management, in which the initiative will come largely from holding company interests (as was evidenced at the St. Louis convention), will result in great benefit to the proper control and financing of municipally owned systems.

Considerably less activity in the purchase, by holding companies, of privately owned water supplies has been noted during the past year, partly owing, no doubt, to the financial and business depression. On the other hand, municipalities in general seem to have taken the cue, since an increased number of privately owned plants have been purchased by municipalities.

Increasing attention has been given to the formation of water supply districts and to joint projects. Two of the most important of these projects arranged for or planned during the year are the purchase of the holdings of the Passaic Consolidated Water Co. for $13,000,000 by the Passaic Valley Water Commission formed by the cities of Paterson, Passaic and Clifton, N. J.; and the proposal of the Greater Chicago Lake Water Company to supply filtered lake water to twenty-nine towns and villages in Cook county.

A preliminary report was made by the State Water Policy Commission of New Jersey, created in 1929, covering general plans and recommendations for the development of water supply sources in Northern New Jersey.

In a review by James O. Hazard, assistant forester, Virginia Forest Service, it is stated that a large majority of water companies throughout the northeastern states are definitely planning to completely reforest all idle open areas within their watersheds. In New York State two-thirds of the cities have planted forests around their sources of water supply. Also, fifteen municipalities and private water companies in New Jersey and twenty cities and towns in Connecticut are reforesting their watersheds, while this work has been greatly advanced for many years in Massachusetts and Pennsylvania.

Of special interest in connection with the questions now before the U. S. Supreme Court relating to the proposed development of the Delaware river source by New York City, and of the Swift and Ware rivers tributary to the Connecticut river by the Metropolitan District (Boston) Water Supply Commission, are the questions raised by the attorney-general as to the extent of control which may be exercised by the Federal Government over all streams, whether navigable or tributary to navigable streams. This is clearly a matter requiring engineering study, debate and direction, although, at present, interpretation of Federal jurisdiction does not touch upon water supply.

Serious problems have been present in many parts of the country by reason of the extended drought during the summer of 1930. The deficiency in rainfall, the greatest so far recorded or known in this country, began in March and extended well into the autumn.

From the Weather Bureau records it is apparent that the central-eastern portion of the country has suffered most from lack of rainfall while portions of the northwest, the district east of the southern Rockies, the southeastern states and most of the northeastern states have had normal and above normal rainfall.

As has been the case following serious floods, when river flow conservancy measures have been extensively planned, it is to be expected that steps will be taken at many points, as a result of water shortage, to increase the safe yield of public water supply sources.

Construction.—There are many indications that municipal authorities are planning to take advantage of the favorable situation which now exists for constructing necessary water supply improvements, in addition to doing their share toward the relief of

*Consulting Sanitary Engineer, New York City.

unemployment. The principal advantages which now obtain are:

1. Bond interest rates are low.
2. Cost of labor and materials are at a minimum not expected to be duplicated in the next few years.
3. Public improvement costs impose no immediate material burden on taxpayers.

Fortunately a very heavy construction program in the water supply field has been underway during the past few years, including the Hetch Hetchy project for San Francisco, the Detroit improvements, the new water tunnel under New York City, the Metropolitan District (Boston) work and the Cobble Mountain reservoir for Springfield, Massachusetts.

New projects authorized or planned during the year include the following:

Purchase of water rights and riparian land and improvements to the Los Angeles supply, to cost $38,800,000.

The Hoover dam in Boulder Canyon which will impound sufficient water above power and irrigation needs to furnish additional supply for the metropolitan district around Los Angeles and other districts.

The Delaware river project of New York City, authorization for which is now before the U. S. Supreme Court, will cost, it is estimated, $274,000,000 and will require 25 years for completion.

Denver, in addition to making use of the Moffatt tunnel pioneer bore as a water supply conduit, is planing a 23-mile tunnel from Dillon to Grant, Col., through the continental divide to divert water from Blue river to the proposed Two Forks dam.

The proposed diversion of the Swift and Ware rivers, tributaries of the Connecticut river, to furnish water for Boston was approved in May by the special master appointed by the U. S. Supreme Court.

Four large water-filtration plants for Chicago, to be constructed at a cost of $60,000,000, have been recommended by the city engineer. It is estimated that the cost could be met by increasing the present rate from 6⅔ cents per 1,000 gallons to 8⅓ cents, this increase amounting to one-tenth of what it would cost the citizens to buy spring water.

The city of Cleveland, Ohio, has appointed a commission of three engineers to report on and check over a $60,000,000 development for a regional water supply system.

Water Supply Treatment.—It has been decided, for the present, that instead of revising the Manual of Water Works Practice, published in 1925 by the A. W. W. A., with reference to water treatment, a series of monographs will be published covering current practice.

Work at the Chicago experimental filter has demonstrated that during five to eight months of the year the handling of microscopical troubles incidental to treatment of Lake Michigan water would require such short filter runs with aluminum sulfate as a coagulant that chlorinated iron and lime are proposed.

The adoption of ammonia-chlorine or chloramine treatment of water is increasing. It is found, in some instances, that in addition to more effective sterilization, tastes and odors are more effectively removed.

Super-chlorination and de-chlorination with sulphur dioxide have proven successful at most points where tried, but at some plants activated carbon treatment has been more effective in removing tastes and odors, especially when used supplementary to super-chlorination. Activated carbon treatment has made rapid progress and been widely accepted during the past year.

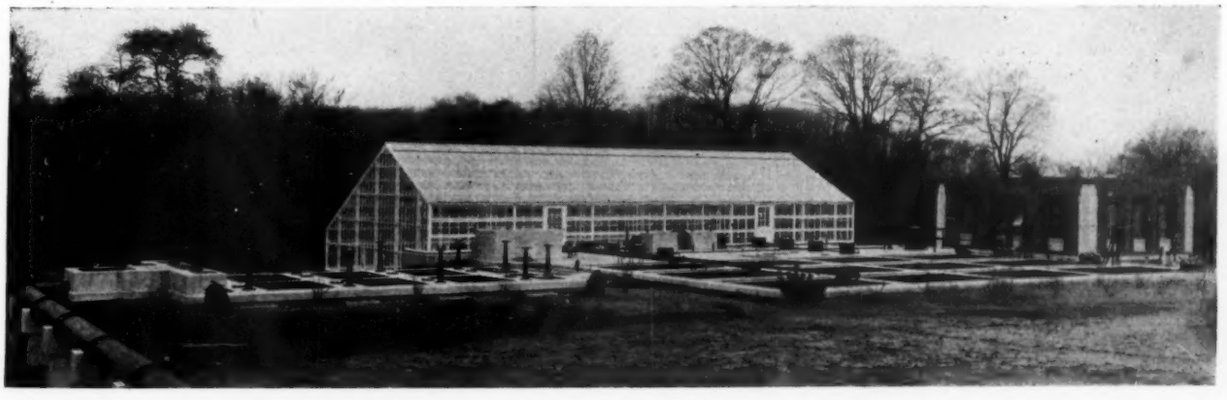
At Columbus, Charles P. Hoover has reached the definite conclusion, after plant scale tests of excess lime method of water softening, that this new, improved process would have saved $400,000 in operating costs as represented by the saving in the quantity of soda-ash applied over a period of twenty years, had the process been available.

Typhoid Fever Suppression.—Typhoid fever death rates continue to be low. However, as has reeently been pointed out, the term "vanishing typhoid" is a dangerous characterization if based primarily on the fact of the great increase in water treatment, as witnessed by such epidemics as one occurring recently in a New York State city. This city, which effectively filtered and chlorinated its main water supply, was seized by an epidemic of over 200 cases of typhoid and 18 deaths, caused by infiltration into a suction main of polluted river water, insufficiently chlorinated. Damages paid by the city to the victims or relatives have amounted to $425,000.

Sewage Treatment

General Status.—A very comprehensive program for legislation to bring about more uniform and effective action to prevent waterways pollution, or, as this aim has recently been more effectively stated, to bring about river cleaning, has been promulgated on

(Continued on page 44)



General view of the Barrington, N. J., sewage treatment plant completed in 1930

Operating Results at the Worcester Sewage Treatment Plant

The Worcester, Mass., plant has been described, and data concerning its operation during the previous year given, in past issues of PUBLIC WORKS. *The following article gives information concerning its operation as found in the annual report for 1929 of the superintendent of the Sewer Department, John H. Brooks, Jr.*

Briefly, the plant consists of grit chambers, screens, Imhoff tanks, dosing tanks, trickling filters, secondary settling tanks, and sludge drying beds. It was designed to treat 28 m.g.d. It started operating in June, 1925.

THE average flow of sewage in 1929 was 20.77 m.g.d., which is much less than in 1928 or 1927 because of the dry weather. However, a 30 m.g.d. rate was exceeded 11.5% of the time; 40 m.g.d. 5.0% of the time; 50 m.g.d. 2.4%; and 65 m.g.d. 0.5% of the time, reaching this on twenty days during the year and for a total of 9 hours in February, 7½ in January and 6½ in March.

Despite the decreased sewage flow, the total amount of sludge produced was 23% greater than in 1928, averaging 2,847 gallons per million gallons of sewage treated; and the dry solids increased from 4,504 tons in 1928 to 6,020 tons in 1929, an increase of 33%. The percentage of volatile matter in the sludge showed a decrease from 1928, as did also the nitrogen; indicating, says Mr. Brooks, a possibility that more mineral solids are passing the grit chambers during storm flows.

"Difficulties with rags clogging the inlets to the sludge pipes in the hoppers of the Imhoff tanks continue to retard drawing sludge from the tanks and necessitate considerable extra work and expense. Efficient screening would relieve this condition and is now receiving serious consideration.

"Routine operation of the tanks has included an occasional squeegeeing of the bottom slopes of the sedimentation compartments of a few tanks and freeing of the slots at one end of the tank, punching holes in the scum, clearing rags away from the entrance to the influent pipes, monthly determination of sludge elevations and monthly reversal of direction of flow of sewage. Gas ebullition has indicated effective digestion of sludge at all times. In addition to the removal of sand from the side channels of the tanks, small quantities have been removed occasionally when reversing the direction of flow of sewage.

"The quantity of grease removed from the sedimentation compartments, principally of tanks Nos. 11 and 12, totaled 7,282 cubic feet, an average of 19.9 cubic feet per day or 0.97 cubic foot per million gallons of sewage passing through the tanks. This quantity is approximately 2,000 cubic feet less than that removed during 1928. Installation of sluice gates opening downward in tanks 11 and 12 is under consideration for the purpose of facilitating removal of grease. It is believed that hand skimming can be eliminated. Disposal of skimmings is by burning at the present time but future plans of parking the plant probably will require a change of location."

The cost of removing dried sludge from the beds averaged 59.7 cents per cubic yard, not including a small expenditure for oil, grease and repairs of the loader, which might add between 2 and 3 cents per cubic yard. During eight months the sludge was handled into horse-drawn Watson dump wagons by means of a Barber-Greene loader; during the other four months it was removed with forks. The cost included $157.62 for gasoline, $504.35 for foreman, $4,238.35 for labor, and $5,803 for teams. A large quantity of partially dried secondary tank sludge is included, which required extra labor in preparation for machine cleaning on account of excessive depth. This sludge was pumped during last winter and dried very slowly.

The sludge beds occupy an area of 21.95 acres (old sand filters) divided into 22 beds. Recommendations have been made for improving the facilities for distributing sludge on the beds, including reducing some of the beds to half their present size.

Because, it was believed, of the dryer weather and consequent stronger sewage, the tank effluent was not quite so good as in 1928, although the percentage reductions of settleable solids, suspended solids, and biochemical oxygen demand were greater.

The suspended solids removed by the tanks averaged 62.8% according to the Gooch determination in the daily samples, and 57.6% as measured by differences in monthly determinations of total solids in unfiltered and filtered composite samples.

The settleable solids removed averaged 93.3% according to the one-hour test of daily samples of sewage and tank effluent, and 88.5% by the two-hour test.

The B. O. D. was reduced by the tanks from 178.5 to 114.0 p.p.m., a removal of 36.2% of organic matter.

The pH of Imhoff tank sludge was quite uniformly 6.8 or 6.9, that of the scum 7.5, that of the lower sewage in the sedimentation compartment 6.4, of the upper water in the sludge compartment 6.5, and of the top sludge in the tank 6.7.

The trickling filters treated an average of 19.9 m.g.d., or 1.46 m.g.d. per acre, of tank effluent.

"Filter operation has followed the usual routine from day to day with one exception; the filters have not been harrowed in the spring and fall. The total number of nozzles cleaned was 87,685, an average of 240 per day or 17.6 per day per acre in use. This is a large increase as compared with last year and has been uniform throughout the entire year. Leaves, together with unusual cold temperature during November, resulted in a Monday cleaning of 2,600 nozzles, or 87 per cent of the total number of nozzles in use.

"Treating stronger Imhoff tank effluent, the trickling filter effluent has contained more organic matter

(*Continued on page 76*)

Aeration Corrects Taste and Red Water

Trickling through a series of charcoal-filled troughs removes aggressive character of water

By K. W. Grimley

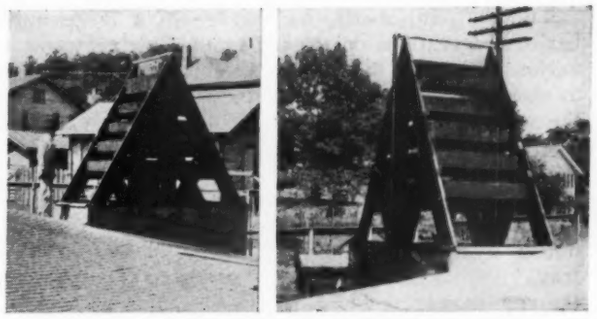
Assistant Sanitary Engineer, Jefferson County, Alabama, Board of Health

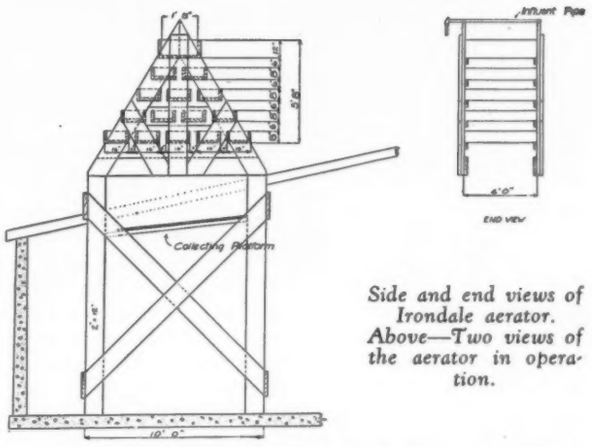
DURING the spring and early summer of 1930, numerous complaints were received from customers of the Alabama Water Service Company's system at Irondale—a suburb of Birmingham, Alabama—regarding the taste of the delivered water.

Water for this community is obtained from three springs located in a sandstone formation on the south slope of Red Mountain, not far from the center of the town, and is delivered by gravity to a large covered concrete storage sump, holding about one week's supply; from which it is pumped to an elevated standpipe above the town. Chlorine is added to the pump suction by a Wallace & Tiernan chlorinator.

On receiving the complaints, an inspection of the system was made by the writer in July; at which time the water did seem to have a distinct, unpleasant, "mineral" taste; which appeared to become progressively worse the further out from the point of supply the sample was secured. A red turbidity also appeared in samples taken from outlying sections of the system. A partial analysis of the water taken from a centrally located hydrant was as follows: pH, less than 5.2; total alkalinity, 8 ppm; CO_2, 46 ppm. This indicated clearly the trouble: the extremely aggressive water was probably dissolving iron from the distribution pipe lines.

Raw water (left) and aerated water (right) to Bromcresol purple.





Side and end views of Irondale aerator. Above—Two views of the aerator in operation.

In the first, more or less experimental, attempt at treatment, the company installed a home-made solution-type lime feeding outfit, discharging into the storage sump. This resulted in vigorous protests from water users, mostly because of a psychological objection to a "doctoring" of the water supply; although there were a few more rational complaints, alleging an unpleasant sweetish taste in the treated water. In any event, the customer being always right, the attempt was discontinued.

Failing to improve the situation by chemical treatment, the company resolved to try aeration. Unfortunately, only about two feet difference in elevation exists between the water level in the springs and the water level in the sump; and in order to obtain the necessary head, pumping of the raw water had to be resorted to.

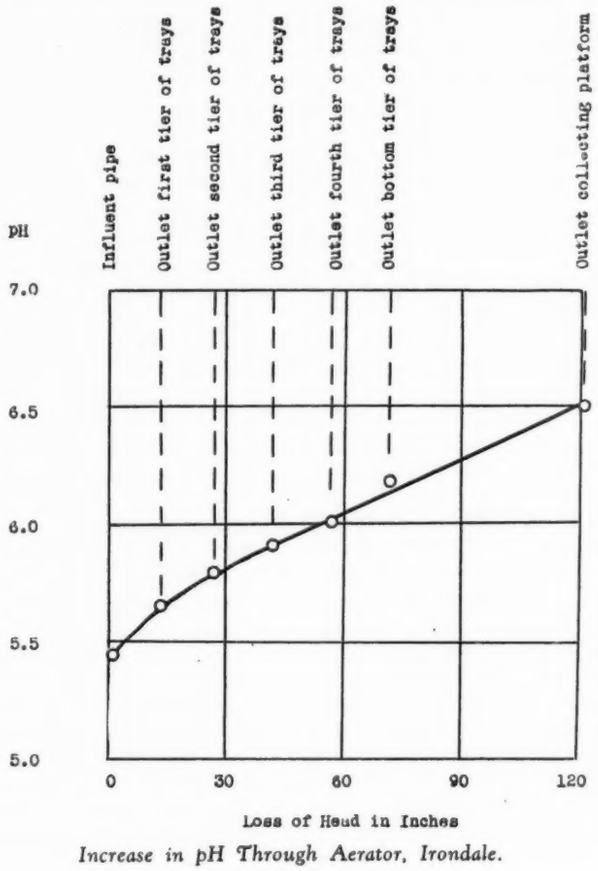
The drawing and photographs accompanying this article illustrate the aerator finally constructed. The design was based on a capacity of 50 gal./min. Two braced A frames support fifteen wooden trays containing coke, arranged in five tiers as shown. Water is sprayed into the top tray from a perforated pipe extending across the top of the A frames. The wooden trays, filled to within two inches of the top with nut coke, have perforated bottoms through which the water drips to the tier below. From the lowest trays the water drops about four feet to a collecting platform, from which it falls into the storage sump.

The rather elaborate arrangement of trays was employed to minimize the loss of water through wind action. The writer was rather skeptical as to the evenness of distribution of flow to the lower tier; believing that the greater quantity would fall into the central trays; however, actual operating results have been that the distribution is governed more by the tendency of the small holes in a given tray to swell shut than by any other factor.

The diagram shows the average of a large number of observations on the pH of the flowing water at various points in the structure. The curve is plotted to show the relation between the pH and the distance the water has fallen from the influent pipe. A most interesting point in this connection is that the aeration per inch of fall through the unobstructed drop between the bottom of the lowest tier of trays and the collecting platform, appears to be as great as that produced by an equivalent fall through the aeration trays! In other words, this suggests that possibly the results obtained would have been just as satisfactory if all the coke-filled trays had been omitted.

As mentioned above, some of the holes in the bottoms of the various trays have swelled shut; and as a result, some of the trays stand full of water when the aerator is in operation, as the water falls into them from above faster than it can flow out through the remaining holes. Other trays do not stand full. Now it would seem logical to assume that the trays in which the coke is *not* submerged would prove much more efficient in raising the pH of the water flowing through them, than those trays which are at all times full to the brim with water; because in the former case the water would splash from one piece of coke to the next, in longer and more intimate contact with air. However, our observations tend to show that this difference in efficiency, if it exists at all, is of small practical importance, as we could detect no difference in the operating results of trays standing full and those standing empty.

As may be noted, the results from this aerator to date have been the raising of the pH of the treated water from 5.2 to 6.5. While this is a fairly satisfactory gain for this type of treatment, representing a theoretical reduction in CO_2 from 40 ppm to 5ppm (about), the effluent still represents a potentially corrosive water. As a final step, raising the pH to 7.4, the rather crude but nevertheless effective expedient is employed of placing one block per day of "Purite" (a compressed sodium carbonate cake manufactured by the Mathieson Alkali Works) on the collecting platform. The falling water dissolves one cake in about eight hours; and while the dosage is not as uniform as might be obtained from some constant feed device, the long subsequent storage may be depended upon to equalize the results.



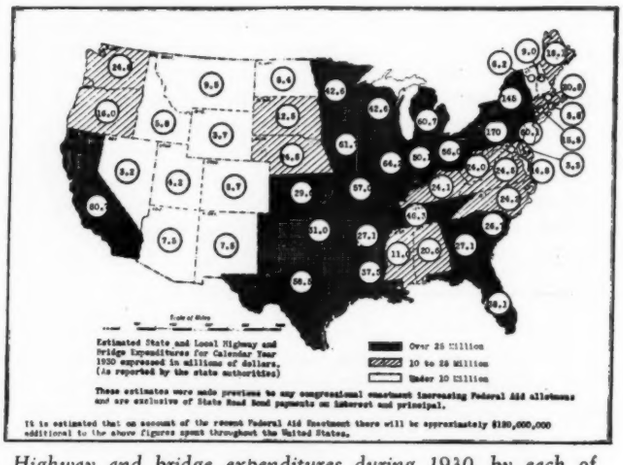
Increase in pH Through Aerator, Irondale.

Since the installation of this equipment, at a total cost including raw water pump and motor of about $350, no further complaints have been received. The treated water is decidedly improved in taste and appearance, and should be much less destructive in its action on pipe lines.

The installation was designed and constructed by C. H. Ellis, of the Alabama Water Service Company.

Highway Expenditures in 1930

The result of a survey which it has made of the state, county and local expenditures this year for highways and bridges has just been made public by the American Road Builders' Association and the totals by states are shown graphically on the accompanying map.


Estimated State and Local Highway and Bridge Expenditures for Calendar Year 1930 expressed in millions of dollars. (As reported by the state authorities)
Over 25 Million
10 to 25 Million
Under 10 Million
These estimates were made previous to any congressional enactment increasing Federal Aid allotments and are exclusive of State Road Bond payments on interest and principal.
It is estimated that on account of the recent Federal Aid Enactment there will be approximately $120,000,000 additional to the above figures spent throughout the United States.

Highway and bridge expenditures during 1930, by each of the States.

This shows that about $1,600,000,000 is being spent this year; probably more than this, as the data on which this estimate is based were collected previous to the decision to make additional Federal aid funds available immediately; which will, it is estimated, add approximately $120,000,000 to the total expenditure.

It will be noticed that more than half the total is being spent within a 500-mile radius of St. Louis. Only one state west of the Rockies is spending more than 25 million dollars, and only three more than 10 million. Of the seventeen Atlantic coast states, only six are spending more than 25 million. This is due largely to the fact that their road systems are well on the way to completion. However, three of the oldest—New York, New Jersey and Pennsylvania—are spending large amounts on repaving and maintenance of roads built early in the present road-building era.

This mixer laid fifteen miles of pavement during the 1930 season.

Fifteen Miles of Concrete Pavement Laid This Season With One Mixer

WM. EISENBERG & SONS, INC., Camden, N. J., have completed a contract in Lehigh County, Pennsylvania, involving the construction of 11.39 miles of concrete highway 18 feet wide and of 8-6-8 thickness. The equipment consisted of a Koehring 27-E paver; a fleet of rented trucks, most of them International, Mack and Hahn, with 3-batch bodies; Blaw-Knox forms; a Lakewood screed; and dirt-moving equipment. The haul to the mixer from the batching plant was long, and 14 trucks were required for supplying aggregate to the mixer. Calcium chloride is used as a curing agent in solution. A C. H. & E. pump supplies water through a 2-inch line. Carey expansion joints were used.

The contract also involved considerable grading. Four power shovels were used—Two Bucyrus-Erie 1¼-yard gas + air; a ¾-yard steam Erie; and a 1-yard Koehring gas shovel. These loaded into motor trucks, which carried the excavated material out to the fills or to waste. Two Keystone graders were used on cleanup and fine grading. Other equipment included a Caterpillar road patrol, which proved very useful in fine grading, and four Caterpillar bulldozers.

The batching plant consisted of an Erie Aggremeter bin, which was loaded by the ¾-yard Erie shovel working as a crane. There were also two Ingersoll-Rand air compressors, which were used for drilling in the rock cuts.

The record achieved in laying pavement was exceptionally good. In 58 working days, 43,586 feet of concrete pavement 18 feet wide was laid, an average of 4,509 feet per week of 6 working days. The maximum day was August 30, when 1,047 feet of completed pavement was put down. Other good days were July 29 and 31, when the footage was in excess of 1,020. For the most part, though, progress was ac-

Week Ending	Working Hours			Per Cent of Time Utilized	Total No. of Batches	Batches Per Actual Working Hour	Per Cent Maximum Efficiency
	Possible	Lost	Actual				
July 9	51.00	3.00	48.00	94.12	1488	31.00	78.00
16	60.00	2.00	58.00	96.66	1903	32.82	82.05
23	77.50	4.83	72.67	93.77	2318	31.90	79.75
30	62.00	5.59	56.41	90.98	1927	34.16	85.40
Aug. 6	64.00	5.00	59.00	92.18	2082	35.30	88.25
13	60.50	7.92	52.58	86.91	1856	35.30	88.25
20	47.50	2.60	44.90	94.53	1450	32.30	80.75
27	52.75	4.50	48.25	91.47	1636	33.90	84.75

complished by steadily excellent work, rather than by occasional very high runs.

The accompanying table shows the record of efficiency of this organization for the months of July and August, according to the form used by the Pennsylvania Highway Department.

This record was accomplished despite the long haul, averaging 8 miles, with much opportunity for delay to the batching trucks from traffic. It was the result of good management and continuous skilled operation of the mixer. As a rule, three trucks were maintained at the mixer at all times (one dumping, one in line and one in reserve), so as to avoid a shortage of materials. The mixer gang averaged about the usual 32 men, but organization was good. There was no lost time in bringing the subgrade to proper section when this was necessary. The tester was brought down half-way for testing, the mixer was always moved with a batch in the skip, and other essentials were observed. The mixer on this job completed about 15 miles of full-width highway during the 1930 season—a most unusual mark.

C. H. Shotten was chief inspector on this job for the Pennsylvania Department of Highways.

Reports of Sewage Treatment Plants

Standard forms for reporting the operating procedures and results of sewage treatment plants recommended by the A. S. M. I.

THE report at the convention of the American Society for Municipal Improvements of the Committee on Sewerage and Sanitation was devoted largely to advocating the general adoption and use of a standard form for reporting on the operation of sewage treatment plants; submitting forms which it suggests be used as a basis, although use of them will probably suggest some changes needed to make them generally acceptable.

The report says: "The Committee feels that a standard form should be used by the operators of sewage disposal works to record the results obtained in their plants. The Committee realizes that no standard form can be devised to meet the requirements of every plant. It is recognized that a particular plant may present conditions that make a special situation; but such conditions should be recorded, and the effect of these conditions on the results will be evident by comparative analysis if standardized information is kept. In the plants where special conditions exist, additional data regarding the particular cause for the results should be recorded, with the methods used to offset the detrimental effects and a notation as to certain results which are more or less affected on that account. Complete information is desirable to insure proper analysis of field data. Special conditions in plants include occurrence of milk wastes, unusual odors, industrial wastes, and the condition of the sewage when it enters the plant, whether particularly septic or not.

"The Committee recognizes that it is impossible to keep the complete data in many plants, due to lack of personnel, and particularly trained personnel; but as much as possible should be kept. In Form No. X there is outlined the data that it is felt can be kept by any plant. The Committee realizes that only certain parts and combinations of these forms will be used in the different plants. It will not attempt at this time to indicate how results should be weighed as to importance, but feels that standardized recording of results will assist in the establishment of proper measures of the success of sewage plant operation and may lead to better understanding of the varying conditions affecting sewage disposal."

Ten forms were submitted, nine for reporting in complete detail the operations of large plants, well equipped and manned; the tenth for small plants. The reports are classified under the following heads: (1) Clarification; (2) Biologic Filters; (3) Activated Sludge; (4) Clarified Sewage; (5) Contact

(Continued on page 70)

General Form of Report for Small Plants

Units in Plant ..... Population Connected .....

Designed to serve ..... For the Month of.....19....

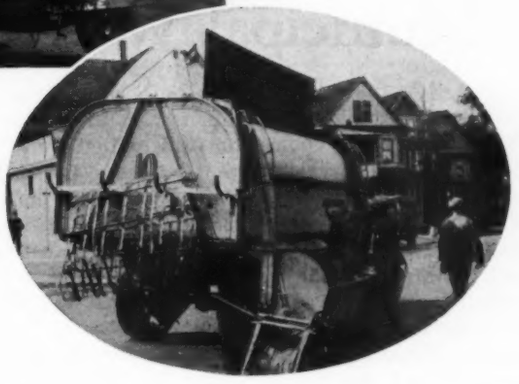
Day of Month	Sewage flow in Gallons	Screenings in Pounds (Percent moisture)	Sludge in Pounds (Percent moisture)	Imhoff Cone Tests		Sewage Temperature			"PH"
				Influent % settleable Solids	Effluent % settleable Solids	Maximum	Minimum	Influent	Raw Sewage
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)

"pH"		Quantity Gas M. Cu. Ft.	Relative Stability of Effluent	Residual Chlorine	Nozzles Cleaned per Day	Activated Sludge Cu. Ft. of Air per Gal. of Sewage	Activated Sludge % of Returned Sludge Based on 30 Min. Settling	Skimmings	
Digestion Tanks	Sludge Withdrawn							In Pounds	Percent of Moisture
(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)

Results listed in Columns 2, 3, 4, 6, 7, 8 and 9, 13 to 17 inclusive to be made daily. Results listed in Columns 10, 11 and 12 to be made weekly.

Modern Refuse Collection Equipment Eliminates Complaints in Bridgeport, Conn.

TO eliminate the nuisance ordinarily considsidered inseparable from the use of open or partially covered vehicles for collecting garbage, rubbish and ashes, Bridgeport, Conn., a city of about 150,000, has arranged for such collection by a contractor who agreed to adopt a modern type of closed collection vehicle. This equipment has been in service for several months, and its use has effected such an improvement over the old service that complaints have been almost entirely eliminated, averaging only about two per day and these relating principally to missed ash collections.



At the left is shown the ease of emptying a barrel into the trough. Below is shown the method of carrying bed springs and the like.

Until last spring, the city operated its own refuse collection service. Garbage was collected separately, and ashes and rubbish together. Two collections of garbage were made weekly in residential areas, and daily collection in the business district. One collection of ashes and rubbish was made. The equipment used consisted of trucks, trailers and wagons. For the most part, the method of collecting into trailers hauled by horses was employed. These trailers, when filled, were picked up by motor trucks and hauled to the disposal area in trains of three or four. As is the usual case, the use of canvas or other temporary covers did not prevent a certain degree of odors and spillage while loading and in transit.

There were engaged on this work 22 trailers, 5 motor trucks and about 40 horses. Of the 5 motor trucks, 3 were normally engaged on ash and rubbish collection and 2 on garbage. The budget for garbage collection for 1930 is $64,654, of which $47,000 is for salaries and wages, and $14,500 for maintenance of vehicles. The budget allowance for ash and rubbish collection is $91,447, of which $66,500 is for salaries and wages, and $15,000 for maintenance of vehicles. It will be noted that the budget allowance for refuse collection is thus almost exactly $1 per capita. All collections were made from the curb, the householder being required to remove the refuse from the back yard to the street.

The amount of garbage collected has averaged 60 tons per day, with a maximum of about 80 tons.

Ashes and rubbish are used for filling, principally on city-owned land along the water-front. This has resulted in the creation of an extensive and beautifully developed park along the sound. Garbage is disposed of by reduction. On a hold-over contract, the rather high rate of 5 cents per pound is being received for grease, but comparatively little for tankage. The total income is around $2.50 per ton of the garbage delivered at the reduction plant. Actual costs of reduction are not now available, but they are undoubtedly considerably in excess of the income, when interest, depreciation and other overhead costs are considered.

The reduction plant is now undergoing repairs, and garbage is being buried on city-owned property by the deep-trench method.

Collection facilities and costs were as outlined above when Sharp Mossop, last April, was awarded the contract for collecting garbage, rubbish and ashes, payment for the service to be made from the city funds. Under the terms of the contract, he was to make two collections of garbage weekly in the residential sections, and daily collections of garbage in the business districts. Ashes and rubbish were to be collected weekly. Instead of curb service, he was to collect all wastes from the backdoor. He was to employ a modern and approved type of closed collection vehicle. His compensation was set at the monthly budget allowance, that is, exactly what it was costing the city to do the work, approximately $13,000 per month. He took over the city collection personnel.

Thus the city gained collection from the back door instead of from the curb, and greatly improved collection equipment, at no extra cost, but it had to provide funds for two inspectors of collection—one for garbage and one for ashes and rubbish—who previously had been paid from budget funds allotted for refuse collection. This amounted to about $5,000 a year.

The contractor purchased nine Colecto 10-cubic yard bodies mounted on Mack AB chassis. These, as shown

in the accompanying illustrations, are loaded by dumping into a small trough or container only waist-high, which reduces greatly the labor required of the men. This container, when filled, is raised by a power take-off from the truck motor and dumped into the body, which is tight, and there is no opportunity for spillage of garbage or ashes, and odors also are eliminated. The vehicles are kept clean and neat, and are not objectionable in appearance either while loading or when loaded and en route through the streets to the disposal area. So far, they have been very satisfactory and, as already stated, their use has resulted in a virtual elimination of complaints due to spillage, odors while in transit, etc. A highly favorable public reaction to their use has been noted.

The loading operation was observed by the writer on a windy day on units collecting ashes and rubbish, including paper and trash. With the usual open type of equipment on such a day, observation is likely to be unpleasant. In this case, however, there was practically no spillage of either ashes or paper. Moreover, the purpose of the unit cannot be identified by the uninitiated except for the universal custom of the trade to festoon collection vehicles with stray bits of waste, such as discarded bed springs and miscellaneous barrels and boxes.

The Department of Public Works, of which J. J. McGuiness is director, has charge of all refuse collection activities. F. L. Sullivan is in charge of garbage collection and J. F. Fennel of ash and rubbish.

Municipal Water Softening vs. Domestic*

ALMOST every family in the United States pays for softening the water it uses in washing. If there is a municipal softening plant which turns out soft water, the user pays for the softening as part of his water rate or taxes. If there is not, and water with any appreciable amount of hardness is delivered to his house, he must soften all that is used with soap for washing his hands, clothing or any other articles; for soap will not lather until the hardness has been neutralized. He may use borax, sal-soda, or tri-sodium phosphate; but most persons use excess soap (often without realizing it) for this purpose.

Use of any of these, but especially the last, costs him more for softening his washing water than it would cost to soften his entire supply at a municipal plant.

Practically all industries requiring soft water (except those located in the relative small area of the country where the waters are naturally soft), such as laundries, ice plants, canning factories, etc., have installed softening plants. Plants for softening or partially softening water supplies have been installed by 134 municipalities in the United States. But large numbers of cities and villages are supplying water that should be softened.

Hardness is caused by either calcium bicarbonate, magnesium bicarbonate, calcium sulphate or magnesium sulphate held in solution. To soften the water these are rendered insoluble and removed by sedimentation and filtration, or by replacing the calcium and magnesium with sodium.

Incidentally, but of great importance with some waters, softening processes remove any iron that may be in solution.

Most, if not all of the waters of twenty-nine of the states carry at least 55 parts per million of hardness; the states in which the normal waters are softer than this being Washington, Oregon, the New England States, New York and the other states on the Atlantic coast except Florida, Alabama, Mississippi and Louisiana.

Ohio leads in number of cities and villages with softening plants, having 34; Pennsylvania has 20; Missouri and Florida each has 12; Michigan, 8; Kansas, 7; North Dakota and Illinois, each 5. Seventeen other states have been 1 and 4 each.

Hardness, combined with soap, forms curds which turn clothes gray, and deposits a "rim" on tubs and basins, combines with grease and adheres to dishes, irritates the skin, makes combing the hair and shaving difficult and unpleasant. Hard water is said by canners to toughen peas and ripe beans in canning.

One pound of lime costing one-half cent will soften more water than 20 pounds of soap. Foulk (Geological Survey of Ohio) estimates that 0.9 gallon of water is completely softened per capita per day; a special committee for Madison, Wis., estimated 1.7 gallons, and the Water Commission of St. Louis, 1 gallon. It has been found that 0.2 pound of soap is required to reduce the hardness of 1,000 gallons by one part per million.

Based on these assumptions, the amount of soap wasted in softening hard water to 85 parts per million, for a family of five persons, would range from 28.5 pounds per year where the raw water has an average hardness of 150, to 182 pounds where the hardness is 500. Figuring soap at 12 cents a pound, this gives a loss of $3.35 to $21.85 per family per year, or 67 cents to $4.37 per capita.

Columbus, Ohio, with a population of 300,000 and an average for the past 21 years of 164 p.p.m. of hardness removed would have used 14.37 pounds per year per capita, and spent $517,320 a year. This is about 71 cents per month per family. Columbus softens its water at a municipal plant, and the average water bill for a family is 75 cents per month. It pays $17.52 per million gallons for chemicals, or a little less than 0.011 cent per part of hardness removed per 1,000 gallons. [The plant cost about $10 per capita; 10 per cent per year (for interest and depreciation) on which would be about 0.017 cent per part of hardness removed per 1,000 gallons.] A test was made in a home containing three adults and two children, using Scioto River water, filtered and sterilized but not softened, with a hardness of 270 p.p.m., for one week; and for another week the

(Continued on page 70)

* Abstract of a paper before the American Society for Municipal Improvements by Charles P. Hoover, Chemist in Charge, Water Softening and Purification Works, Columbus, O.

THE EDITOR'S PAGE

1931 Should Set a Record in Public Works Construction

Cheap money, low cost of labor and materials, and the political advantage of providing work for the many who need it are compelling reasons for increased public construction during the season of 1931. Tax monies stand at approximately the same volume as in the past two or three years. In addition, through tax anticipation notes, money can be raised easily when needed, which was not the case a year ago. Bond interest rates are now low, and public improvements effected through this means impose no immediate material burden upon taxpayers.

It would be a sad commentary upon the vision and courage of our city, county, township and village officials if they should take this period to reduce public works expenditures. Not only would they fail to take advantage of the most favorable period, from the dollars and cents viewpoint, but they would fail their own citizens. In every community, a considerable portion of such construction costs go directly to citizens of that community; and the benefit of the construction goes almost entirely to them.

The last statement is especially true of low-cost roads—a larger percentage of the money spent on these goes to local labor than is the case with high-cost ones, and they are used chiefly by local rather than by through traffic. Moreover, methods of constructing them have been developed to a stage of high efficiency, as has been shown by numerous articles in PUBLIC WORKS during the past year. Never before have the reasons been so urgent for building the maximum possible mileage of these roads.

Refuse Disposal for Small Municipalities

The higher standard of living demanded by American citizens is not confined to their private affairs—they expect it in the various details of municipal housekeeping also. Nor is it confined to the larger cities—travel and the newspaper and magazine have put the small-town man wise to the advantages which community life makes it possible for him to obtain.

Among these advantages is the regular, sanitary collection and disposal of garbage, thus relieving him of the responsiblity for a job too often done in an unsanitary and unsatisfactory way; while the cost of the much more desirable community service is generally less than that of individual arrangements for collection by pig farmers or others.

Such service at its best includes removal of ashes and rubbish also; and removal of the last eliminates the fire hazard caused by private burning of rubbish in back yards. Ashes can often, in a small town, be deposited on near-by low lands by individual householders; but they seldom trouble to level them off, and the appearance of such lot is slovenly and decidedly objectionable in a community which has any pride in its appearance.

Of course, there is a population limit below which it would be uneconomical to maintain community service of this kind. Just what this size is will depend upon a number of local conditions, but may be approximately 10,000 for average conditions. But even in towns smaller than this, community service offers such advantages that it may be considered worth the additional cost.

At present, incineration of garbage and rubbish seems to be the most economical method of disposal in most localities, as well as the most sanitary. With increasing demand for incinerators, the general satisfactoriness of those offered is increasing also, and *vice versa;* and we expect to see a general adoption of this method of disposal by a majority of the larger communities during the next few years.

Valuable Work by the ARBA

A valuable article in this issue on "Trends in Paving Construction," and other articles which have appeared in previous issues of PUBLIC WORKS, testify to the value of the information being collected for the road building industry by the American Road Builders' Association. The work of this organization in making such information available to those engaged in road construction, whether they be engineers, manufacturers or contractors, should be a tremendous factor for advancement in road-building methods and results in the years immediately ahead of us. Paving and road making practices are not yet on a standardized basis. There is plenty of work to do, and few organizations with the money and brains to do it. The ARBA should be encouraged to carry on.

Water Works vs. Fire Engines

One of the editors of PUBLIC WORKS had the following conversation with the leading citizen of a small New York state village, which has no water-works system:

Ed.: "Nice fire engine you have there."
Leading Citizen: "Yes, we're all proud of it."
Ed.: "How much did it cost the community?"
L. C.: "It cost us $6,250."
Ed.: "Where do you get water enough for it?"
L. C.: "Well, it is pretty hard to get any water around here for fires, because the wells are about dry this year; but we can use the chemical, and sometimes we can lay a line to a brook."
Ed.: "But the chemical won't do much after the fire gets started, will it?"
L. C.: "No, we can't do much if the fire gets under way, unless there is a stream or pond handy."

Which set us to thinking. We don't know just how much it would cost for a water works system for this village; but undoubtedly the annual cost, including the saving by insurance reduction, would not be much greater than that for the fire engine, while the convenience and fire protection would be.

We wonder how many other villages are similarly fixed.

Equipment and Organization Speed Work On Highway Construction

ON the construction of 6.37 miles of concrete highway in Cambria county, Pa., J. I. Dick, of Scottdale, employed modern equipment and methods, with the result that an exceedingly high average rate of production of pavement was maintained. In addition to the 18-foot, 9-7-9 concrete pavement, the contract required relocation on practically the entire length of the road. Excavation

The mechanical strike-off saves the men a great deal of exceedingly hard work and speeds up the job.

amounted to 99,185 cubic yards. This was handled with four shovels, one Lorain "75," 1¼-yard, one Link-Belt gasoline shovel, 1¼-yard; and two Erie steam shovels with ¾-yard buckets. All these loaded into trucks. A caterpillar bulldozer was used to level the fills. On clearing and grubbing work, the larger stumps were blasted and then pulled out with the tractors or lifted out with the shovels. The smaller ones were no problem for the shovels.

For fine grading, a Galion-McCormick Deering crawler grader and an Austin grade roller were used. Two fine grade crews were used, each crew having about ten men. Blaw-Knox forms were set well in advance of the work. For setting these, a Carr form grader was employed.

The plant for the unloading of the material was located at Dysart, 3.34 miles from the Ashville end of the project, and 3.03 miles from the end of the project beyond the Dean-Reade township line. The dead haul was only a few hundred feet so the average haul was approximately 3.3 miles.

The equipment used at the material plant was a ¾-cubic yard Erie steam shovel, that had been converted into a crane for unloading material; a Blaw-Knox batcher and bins of 50 tons capacity, and a siding of 12-car capacity. It was necessary to excavate pits for unloading the material from the cars.

This material plant was operated twenty hours a day, so that at all times there was sufficient material on hand. All materials that went into the pavement were proportioned by weight. Stone was used as the coarse aggregate. Continuous inspection was provided at the unloading plant for the additional hours that were worked.

Twelve to fifteen International trucks of 3½-ton capacity, all with pneumatic tires, and carrying three batches each, were used daily to transport materials from the plant to the concrete mixer.

The equipment used for the laying of the pavement included a 27-E Foote mixer of 6-bag capacity, a Lakewood finishing machine, a National Steel Fabric Flex-Plane machine for cleft plane joints, and a mechanical strike-off for the mesh reinforcement.

The mixer organization was as follows:

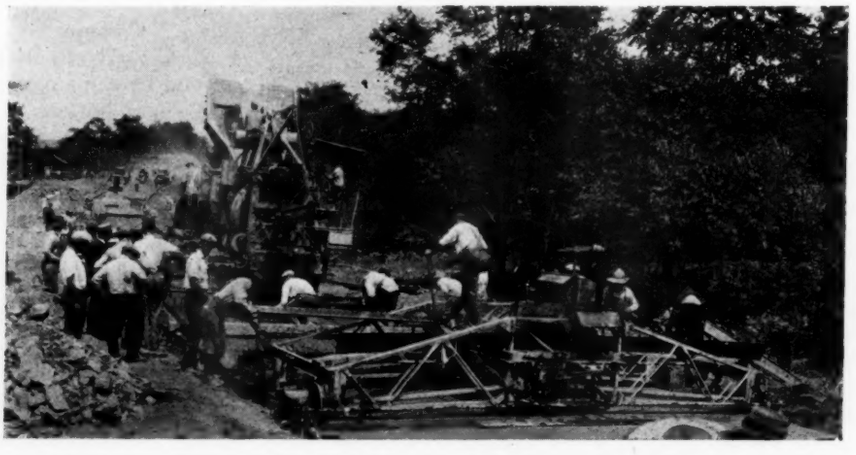
1 foreman
1 mixer operator
1 finishing machine operator
1 Flex-Plane machine operator
1 man on trucks at the skip of the mixer
4 men in pit
2 men on subgrade tester
4 finishers
2 men handling steel reinforcement
2 men spading
2 men on burlap for curing
3 men sprinkling for curing
1 man handling calcium chloride

Total—25 men—used on this operation around the mixer.

Paving operations started July 9 and were completed on September 5. A very satisfactory rate of progress was maintained. The first full week following the beginning of the work, from July 14 to 19, a total of 4,130 feet of pavement was completed, with a high day of 777 feet. The footage for the following week amounted to 4,343 feet, with a high day of 832 feet; on the third week, 4,805 feet were laid, with a high of 855, which was broken the following week when more than a thousand feet was laid in one day.

There was a good supply of water on this job. Only one pump was necessary, and the maximum distance that water had to be pumped was 3.34 miles.

J. P. Stein was senior inspector in charge, under Assistant Engineer S. G. Nowell. C. R. Forbes is division engineer.



C. H. Buckius, construction engineer (hatless and with arms on hips), and C. R. Forbes, division engineer (in straw hat), watching the "wheels go round" on the J. I. Dick job.

Refuse Disposal Methods in Nearly Twelve Hundred Small Municipalities

DURING the past few weeks we have collected data concerning methods of refuse disposal from nearly twelve hundred small municipalities of less than four thousand population located in all the states of the Union. Concise summaries by states are given below of the information so obtained. About half of the communities either reported that this was left entirely to the individual householders, or implied this by failing to answer any of the questions asked about their practice in these matters. A majority apparently provide public collection of garbage only, leaving disposal of ashes and rubbish to the citizens individually.

A tabulation of all the replies combined, giving a composite view of the country as a whole, so far as communities of under four thousand population are concerned, gives the following result:

Twenty-six report use of incinerators for burning their garbage, and 64 burn it in the open, probably on the dumps; while 8 are considering incineration. One turns its garbage over to a reduction company.

Pigs are fed with the garbage from 48 of the communities, either at public pig farms or on privately owned farms. In addition, 2 sell it to farmers and in 18 others the farmers collect it and presumably feed it to their pigs.

Dumping is by far the most common method of disposal. This term, unqualified, is used by 363 of our informants to describe their methods. In addition, 7 dump into pits, 10 into rivers, 10 use it in fills, and 18 bury it. Eleven haul it away, and 62 contract for its removal—method of disposal by contractors not named.

Five dump it into sewers or cesspools, and one onto a "sewer farm." Two dispose of it at a "disposal plant" and one in "tanks."

While there is some uncertainty about the meaning of some of these replies, it is apparent that about 75 to 85 percent of these small municipalities dump their refuse, with or without burying or burning; 10 or 12 percent feed it to hogs; and about five percent destroy it in incinerators.

Alabama.—Reports received from 21 municipalities indicate that incineration is being practiced in one of these, dumping in 9, and burning (probably also on the dump) in 6 places. One community dumps garbage into a pit, one uses rubbish for filling, and 4 did not report in regard to these practices. One community stated that the construction of an incinerator was "being mentioned."

Arizona.—Of four communities reporting, two state that garbage and rubbish are burned on a dump, one reports dumping, and one states merely that such wastes are hauled away.

Arkansas.—Six of 17 communities use dumps, of which 2 report that waste is burned on the dump; 7 report no method; 2 state that garbage is disposed of into a river; one by disposal into the sewer; and one that there is "no regular method—it is just hauled off."

California.—In the 40 communities reporting, garbage is used for feeding hogs in 8, and is sold in 7 others. Probably most of the purchasers also use it for feeding. In 13 cities it is dumped or burned on a dump; 2 have private collection; one "hauls it out of the city"; 2 dispose of their refuse at the "sewer farm." No definite reports were received from 8. One states that: "We have a city dump, and care is taken as to who burns garbage and rubbish."

Colorado.—Of six communities reporting, 2 state that garbage is removed by contract, and rubbish by the street department; while the other 4 do not state methods employed.

Connecticut.—One community employs a public dump; another sells to farmers; another does not state methods. (For a complete report on refuse disposal methods in Connecticut, see the January, 1927, issue of PUBLIC WORKS.)

Delaware.—One community reports disposal of garbage by burial and of rubbish by burning; 2 report the use of dumps; and one does not state any definite practice.

Florida.—Fourteen replies. Three communities employ incineration; one uses garbage for filling a pond; one buries garbage outside the city limits; 3 haul all wastes away and burn them, presumably on a dump; 2 employ dumps; 3 do not state any specific method.

Georgia.—Twenty-two replies. Seven employ a dump and 4 report burning, which is probably on a dump. One city requires the individual to care for the waste, and another says that it is dumped into toilets and cesspools, probably the responsibility being the individual's. One reports dumping in "empty lots." In 2 it is "hauled out of the city" and 6 make no specific reports.

Idaho.—City dumps are reported as in use by 2 communi-

The old-style collection vehicle, with its odorous canvas covers, leaking garbage or spilling refuse in its passage down the street, is a constant source of annoyance and complaint. It should be replaced with a modern closed, odorless equipment, one type of which is shown on the right.

ties; one states "each family takes care of its own"; 2 make no definite report, and 1 contracts for removal.

Illinois.—Ninety-eight replies. Incineration is employed by 3 communities, and in 3 others garbage is fed to pigs. In 19, it is dumped or burned (probably on a dump); farmers collect in one; it is up to the property owner or individual in 11; and there is private collection in 5. Dumping into the river, dumping into a pit or hole, or burial, is employed by 5. Fifty-one gave no data whatever, in most cases probably due to the fact that there was no collection service.

Indiana.—Data received from 42 communities. Garbage is fed to hogs in 2; dumped in 12; burned in 2; removed by contract in 3; by the individual in 2; by farmers in 2; and dumped into the cesspool in one. One city reports no collections; and no information regarding collection was available from 18, probably because there were no collection facilities.

Iowa.—Seventy-six replies. Public dumps are employed in 28 communities, and garbage and rubbish is burned in 4 others, probably on the dump. Garbage is used for hog feed in 3, and is collected privately in 7 others, where it is probably used for the same purpose. It is dumped outside the city in 3 cases, burned in an open ditch in one, thrown into a pit in one, and collected by individuals in 2. In the case of 30 communities, no information was given.

Kansas.—32 replies. In one community, garbage is fed to pigs; in 2, removed to the disposal plant (type not stated); in 11 disposed by dumping; and in 5 removed by the individual or by contract. One village hauls all its waste to an old mine. Thirteen communities either stated they had no provision for collecting such waste, or did not give data.

Kentucky.—Returns from 26 communities. Incineration is employed by one; garbage is dumped in 8 and burned in 4 (probably burned on the dump); it is up to the individual in 2, and is collected by farmers in one. It is hauled to a "storage ground" in one; no data are given by 9.

Louisiana.—Reports received from 14 villages. Dumping is employed by 4, and burial by 2. One community reports dumping in the woods, another states that refuse is "hauled to the drying grounds and burnt." No data, and presumably no collection systems, were reported by 5.

Maine.—Of 6 communities reporting, 2 have private collection, one disposes by dumping, one by burning, and 2 supply no data.

Maryland.—Eleven replies received. Of these, 4 employ dumps; one dumps in the river; one contracts for collection; one disposes of garbage on a nearby farm; 3 supply no data; one sells to farmers.

Massachusetts.—Replies were received from 24 municipalities. In 2, garbage is fed to hogs, and in 3 it is disposed of on a dump. In one of the places using hog feeding, rubbish is dumped into the river. In 19 communities, collection and disposal of wastes is either by the individual or is not attempted.

Michigan.—Forty-one replies received. Garbage is fed to hogs in 6 communities, probably in each case by private collectors. It is collected by farmers by contract in 2, and otherwise by contract in 3 others. The dump is the final place of disposal in 14 places, and garbage is reported burned, probably on the dump, in 3 others. One village reports dumping into a pit, and another as covering the garbage with earth; 12 places report no facilities for collection or disposal. One community is planning a small incinerator.

Though it utilizes some of the values in garbage, feeding it to pigs is likely to produce intolerable nuisance unless great care is observed.

Minnesota.—Replies from 52 villages and cities. Of these, 25 report using dumping; in 2 it is collected by farmers; in 2 it is fed to hogs or buried; 22 report no organized method of disposal or collection.

Mississippi.—Ten replies. Five of these use dumps; in one case it is hauled out of the city, and in another it is burned, probably on a dump. It is collected by contract in one. There is no organized collection in 2 of the 10 places.

Missouri.—Thirty-nine replies. Of these communities, 15 employ dumps; one "cremation" (whether incineration or burning on a dump is not stated); one, "tanks"; and one, dumping to the river. In 3 communities there is private or individual collection; and in 17, no organization is available for collecton or disposal.

Montana.—Replies from 9 communities indicate that dumping is employed in 3; no provision is made in 4; in one, disposal is at the property owner's expense (but the method is not stated); and in one it is hauled away by farmers.

Nebraska.—Replies received from 29 communities. Garbage is buried by one; fed in one; burned in one; and collected privately in one; one dumps into the sewer and one into the river. Of the remainder, 11 report disposal by dumping, 12 report no organized method.

Nevada.—One report received states that both garbage and rubbish are handled by a disposal company, but gives no details. Another states that individual property owners are responsible.

New Hampshire.—Of 6 replies, 3 state that dumps are used; one says that individuals are required to dispose of their wastes; and 2 give no information regarding the method of collection or disposal.

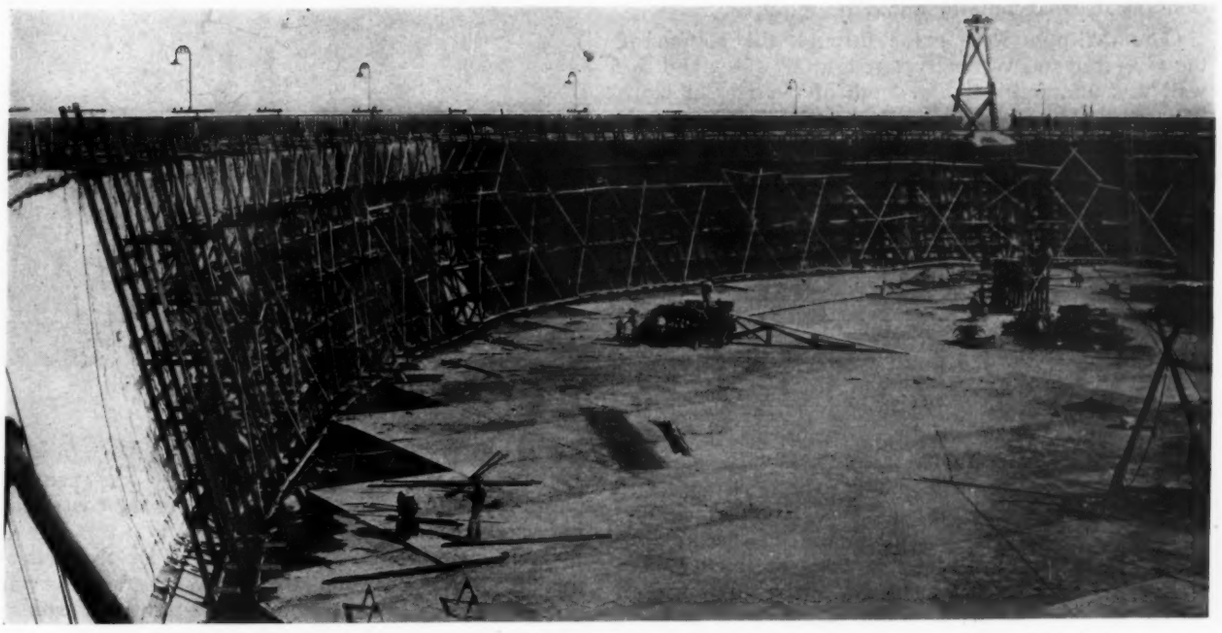
New Jersey.—Replies received from 31 communities. Collection is by contract in 7 places, with no data as to ultimate disposal. It is fed to pigs in one; burned on a dump in one; disposed of by the individual in one; incinerated in one; used to fill swamps and low places (and covered) in 4; dumped in 5; and 11 places report no provision.

New Mexico.—Six replies. Dumps are used by 2 communities, and one dumps in ditches and low ground and covers. It is hauled to the mountains by one, used for hog feed by one, and the remaining one gives no data.

New York.—Replies received from 87 communities. Incineration is employed by 3 communities and 5 others plan to build, or are considering, incinerators. Other disposal methods are: bury, one; dump, 25; burning (prob-

(Continued on page 69)

Dumps where rubbish and garbage are burned in the open are intolerable nuisances and fire hazards. Compare with the neat incinerator in a cornfield on the edge of a small town with advanced ideas.



Showing scaffolding erected for waterproofing the walls and equipment used to gunite over the asphalt lining.

Waterproofing the Nashville Reservoir*

Walls of a five-acre reservoir covered with an asphaltic membrane and this in turn with a ten-inch layer of gunite concrete, giving perfect tightness.

THE city of Nashville, Tenn., in 1889 built, as a distribution reservoir in the eastern part of the city, an uncovered masonry structure, elliptical in plan, with a major axis of 603 feet and a minor axis of 463 feet, giving an area of water surface of a little less than five acres. A masonry wall extended across the short dimension, making two compartments of equal size. The reservoir contained about 31 feet of water when full. The ground level corresponded approximately with the bottom of the reservoir.

In November, 1912, a part of the side wall at the easterly end of the reservoir gave way, involving the displacement of a section of wall about 156 feet long. This was repaired in 1913 at an expenses of over $100,000, which included improvements to the floor and inside wall of the east basin. Work was also done to improve the water-tightness of the bottom and sides of the west basin, though with less thoroughness. The waterproofing was done by using a cement gun to apply a portland cement mortar coating. More or less seepage continued and during 1918 and 1919 coatings of asphalt were placed on the inside surfaces of the walls from time to time. On August 15, 1919, a board of consulting engineers consisting of J. N. Chester, George W. Fuller and the late Leonard Metcalf submitted the result of an exhaustive study of the water works department and made a number of recommendations, one of which was that the distributing reservoir on Kirkpatrick Hill should be made water-tight by a new lining of reinforced concrete with asphaltous membrane between it and the present masonry. It also recommended that the reservoir be covered with a reinforced concrete roof to prevent deterioration of the filtered water. The engineers estimated the cost of lining the resrvoir at $158,500, and that of roofing it at $238,500.

They stated: "Water-tightness is of importance in this case to an unsual extent, for the limestone foundation is interstratified with shale, which softens and disintegrates under contact with water. Therefore, should the water from the resrvoir, under pressure, reach the shale through crevasses or possible faults in the limestone ledge upon which the reservoir is built, there is likelihood that sooner or later the shale would become softened and act as a lubricating layer to such an extent as ultimately to involve the integrity of the structure."

When the reservoir failed in 1912, a geological fault with a vertical throw of ten feet had been discovered running through the foundation of the reservoir wall section. However, these engineers discovered no trace of the fault extending outside the reservoir and reported that they believed the reservoir would continue as a stable structure if the bottom and side walls were made water-tight. No immediate action was taken, and less than a year after this report was submitted, a leakage through a horizontal crack which had developed became so great as to cause concern and the J. N. Chester Engineers were

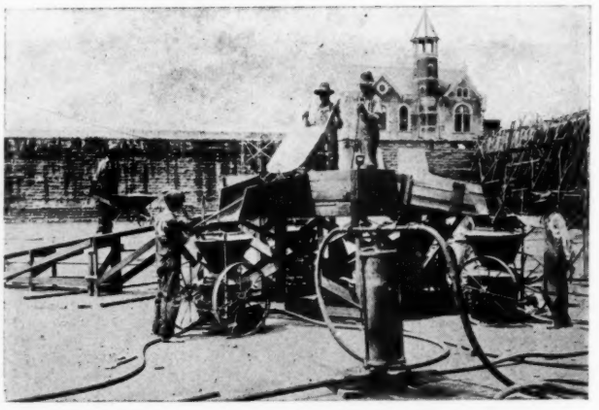
*Abstract of part of a paper entitled "The Nashville, Tennessee, Filtration Plant and Waterproofing of Large Reservoir," read before the convention of the American Society for Municipal Improvements by John F. Laboon, member of the firm of the J. N. Chester, Engineers.

employed to make an investigation and recommendations as to what repairs would be required.

Core drillings were made through the bottom of the reservoir and vertically through the walls, and the wall was undermined to a depth of ten feet or more to permit a study of the rock strata. These investigations showed that layers of shale between the rock strata forming the foundation of the wall had been leached out and softened by water leaking from the reservoir, leaving behind a layer of clay which squeezed and resulted in the settlement and the cracking of the wall. The portions so impaired were excavated and backfilled with concrete and plans and specifications were prepared for waterproofing the reservoir.

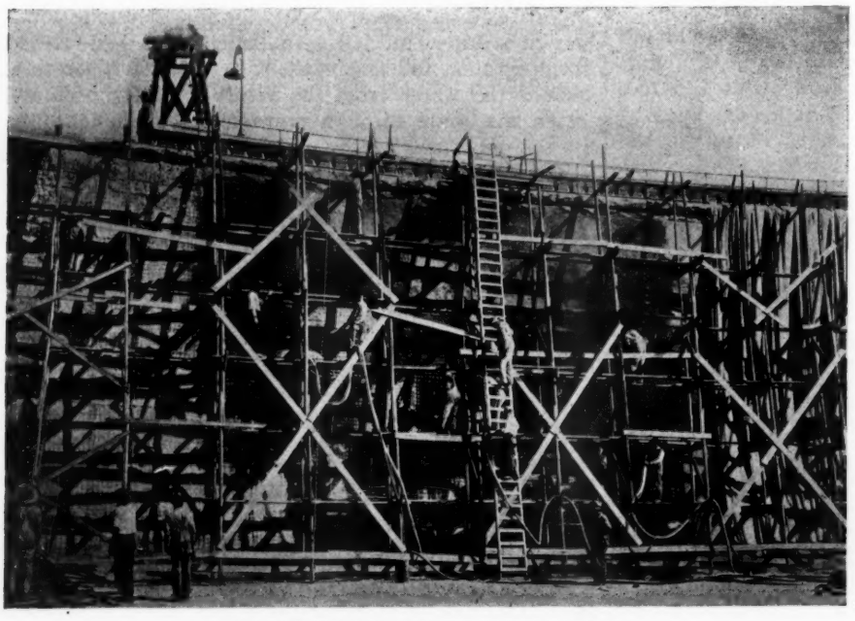
The waterproofing advised by the Board of Engineers was to "apply to the interior surface of all the side walls a waterproof lining made up of several thicknesses of asphaltous membrane. The present coating upon the walls should first be repaired where it is broken, that such benefit as possible may be derived from it. The surface should then be brought to a fairly regular one by a layer of portland cement mortar made by cement gun upon a wire mesh secured to the wall to hold the new material, or by a layer of concrete placed behind forms and reinforced by steel wire mesh, in order to give a new surface smooth enough to prevent destruction of the asphaltous membrane which is to be applied to it and rough enough to hold the asphalt as applied to it later. This membrane of four or five-ply asphaltic felt, mopped on with hot asphalt, or three-ply burlap laid on and mopped with hot asphalt, should be applied to the well-dried surface of the wall after it has been thoroughly coated with asphalt, which should be applied also after the membrane has been attached to the wall. To protect this membrane, a masonry facing should be built against it of 12-inch concrete heavily reinforced to absorb temperature stresses."

Bids were taken on a 10-inch concrete lining to protect the asphaltous membrane, and also on a 3-inch layer of gunite as an alternate. The gunite alternate proved to be cheaper by $18,400 and therefore was adopted, and has proved entirely satisfactory. Alternate bids were taken on a 3-inch gunite floor and a 4-inch concrete block floor, resulting in the selection of the concrete floor, which was $22,100 less than the gunite floor. The final estimate paid to the contractor for waterproofing was $202,647.24.



Platform used for charging materials into gunite equipment.

Contracts were let in May, 1921, for the waterproofing work, and water was turned into the reservoir early in 1922, when a test for water-tightness extending over a period of eight days with 28 feet of water in the east reservoir developed that the leakage, as measured by the drop in the level of the water, making due allowance for evaporation and temperature, was 0.0858 inch, or 6,469 gallons per day, which is really insignificant in amount. Although the Board of Consulting Engineers had recommended waterproofing the west basin only, it was decided to waterproof both reservoirs throughout, thus increasing the cost of the work above the estimate.



Applying reinforced gunite to the wall.

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Underground Water Survey

In 1929 an investigation of Texas ground waters was begun by joint action of the United States Geological Survey, the State Board of Engineers, the State Department of Health, the State Bureau of Economic Geology and the Agricultural and Mechanical College, under an appropriation of $20,000 by the State Legislature. An important problem being studied is a determination of the maximum rate at which water can be withdrawn from an underground reservoir without depleting the supply to such an extent that withdrawal is no longer economically feasible. Other points being studied are salt water leakage and infiltration; sanitary conditions affecting underground water; and obtaining data on recharge, infiltration, flow and geology of various underground reservoirs.

Similar work will be carried on by the Geological Survey in other states.

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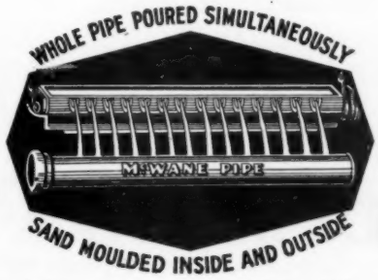

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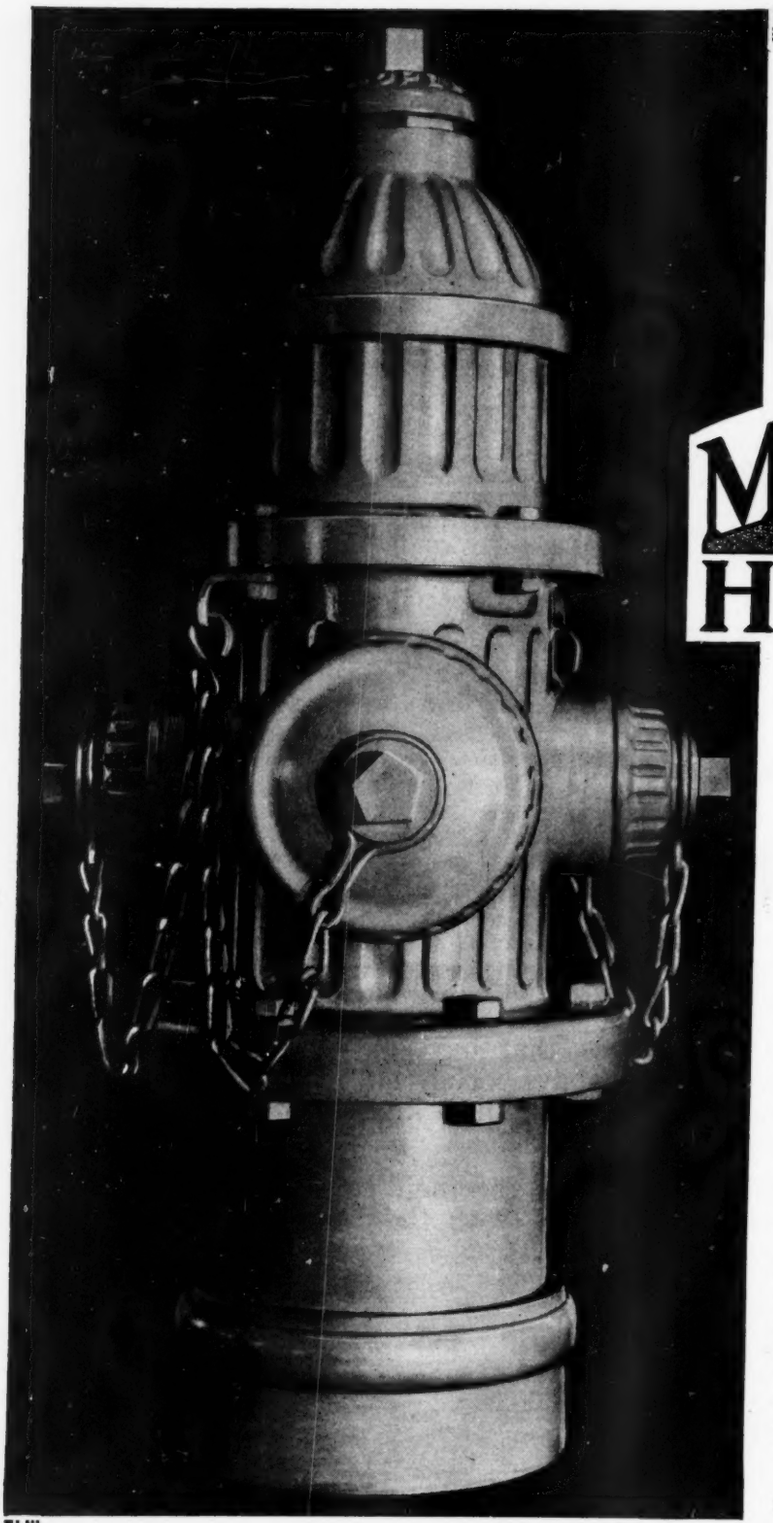

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Read this letter from the Borough of Souderton, Penna.

R. D. WOOD & CO. June 9th, 1930
400 Chestnut Street, Philadelphia, Pa.

GENTLEMEN:

Members of Souderton Borough Council wish to acknowledge with thanks and appreciation the service you rendered in replacing a broken Mathews Fire Hydrant on Washington Avenue, Thursday, April 17th, 1930.

This Hydrant was set in a new cement sidewalk on one of our finest concrete streets, and was struck by an automobile.

We thought we would have to break up the new sidewalk and concrete roadway to dig up the broken Hydrant. You can readily understand our great relief when we learned that by the use of your new Mathews Extraction Tool the broken barrel could be replaced without excavating.

We were agreeably surprised at the efficiency of this Extraction Tool. It enabled us to replace the broken barrel in less than an hour. This time included the repairing of the protection case, which was also broken at the upper end.

When the job was finished there was no indication that the Hydrant had been broken, because the sidewalk and the concrete street had not been disturbed or damaged.

In addition to preserving the appearance of the new sidewalk and street, we saved a considerable sum of money.

We cannot express too strongly our entire satisfaction with Mathews Hydrants and the new Extraction Tool which made all this possible.

Yours truly,

RGA:HVG ROLLAND G. ALBRIGHT, *Clerk*

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Trends in Public Health Engineering

By Isador W. Mendelsohn

Improvements in Quality of Water Supply

Thirty years ago the American public wanted a water free from sediment, and as a result the rapid sand filter came into use. Ten years later, in the search for additional protection against polluted water, chlorine sterilization was perfected. However, as the waterworks operator well knows, objectionable tastes occurred in the chlorinated water. During the past ten years in the process of eliminating these tastes, many changes have transpired in the purification of water.

Today the public in an appreciable number of cities is not satisfied simply with a filtered and sterilized water. Due to the educational efforts of water works officials and sanitarians, the recent public habit of extensive travel, and the greater recognition by industries of the value of treated water in their processes, the public has been informed of the countless attractions of a water which is soft, colorless, clear, non-corrosive, tasteless, odorless, free from iron, manganese, and poisonous chemicals, and disease-producing bacteria, and has definitely expressed its preference for a palatable water. In 1925, when a modern rapid sand filtration plant failed to remove the taste, color and odor due to crenothrix growths and sulphureted hydrogen in the well water of Clarion, Pennsylvania, the people turned to local well and spring waters. The city tried various measures, and finally removed the impurities by aeration and lime and alum treatment prior to filtration. Then the public resumed the use of the city water. Another case illustrative of the changed public attitude is presented by a modern water filtration plant installed recently in a city just north of Chicago. Although the final water was clear and free from harmful bacteria, the people were disappointed with the plant because of its failure to remove the objectionable taste.

The various factors which make a water unpalatable may be grouped under the three headings: physical, chemical and biological, as shown n the outline below. The treatments which have been found successful in eliminating these factors in various communities are also given. The technical literature is replete with the experiences of Hoover in water softening, Baylis with activated carbon, Howard with superchlorination, Weston in iron and manganese removal. Race in chloramination, and a host of others. The application of a specific treatment will depend upon the nature of the impurities and their combination in the water, but sufficient experimental and plant data are available to show that these treatments are effective and economical.

There are several interesting and important considerations in this trend toward improved water supplies. One was well presented in the report of the Committee on Water Supply of the Public Health Engineering Section of the American Public Health Association at Fort Worth in October, namely, that no taste-elimination treatment be considered seriously by water works which causes any sacrifice in the present high standard of bacterial purity maintained by many water supplies. The same policy may be applied to any water treatment process. After all, the chief factor in a public water supply is whether it is free from harmful bacteria and, of course, poisonous compounds. While a new idea in water purification should be given the greatest possible encouragement, it behooves the water works operator interested in the welfare of his patrons to proceed slowly with the installation of the new process, not doing so until after careful and thorough tests have been made. Quick action may cause failure and prejudice the public against water purification in general.

A second consideration is exemplified in the work of Cox, assistant engineer of the New York State Department of Health, in 1928 and 1929. Utilizing the extensive library facilities and contacts of that department and working under a broad departmental policy of assisting municipal water works in solving their local problems, he cooperated with local water works in field tests at Buffalo, Rochester, Lackawanna, Rensselaer and Waterloo, to prevent or remove chlorophenol tastes from the public water. Satisfactory treatment procedures were evolved from this cooperative work. State departments of health in most states have the facilities to assist their municipal water works in solving similar water problems, and can creditably follow such examples as this one by New York.

Public response to the achievements of water works

Impurities in a Water Supply and Methods of Removal

IMPURITIES	TREATMENT
Physical	
Turbidity	Coagulation, sedimentation and filtration
Color	Coagulation with ferric chloride and filtration; chlorination; prechlorination, coagulation and filtration; activated carbon.
Odor	Superchlorination and dechlorination; sulphur dioxide; sodium bisulphite; activated carbon.
Taste	Chloramination Activated carbon; chlorine and permanganate; ozone.
Chemical	
Iron, Manganese	Aeration, coagulation, sedimentation, filtration.
Corrosiveness	Lime; sodium silicate; or caustic soda.
Hardness	Lime and soda ash, carbon dioxide, coagulation, sedimentation, filtration; zeolite.
Poisonous Compounds	Various, or abandonment of the supply.
Biological	
Bacteria	Chlorination; chloramination; or coagulation, sedimentation, filtration, chlorination.
Micro-Organisms	Chlorination; chloramination; copper sulphate.

personnel has been slow comparatively, largely because the facts have not been presented convincingly to municipal officials and the people. Hoover has gradually been winning over cities in Ohio and Pennsylvania to the value of water softening. Much more would be achieved if state departments of health and other informed people were to unite in stressing the advantages of improved water supplies. Happily, a recent example of the results of such united efforts is available. Dr. Imhoff in 1929, when explaining the large increase in sewage treatment works in this country said: "The United States has far more new and good sewage treatment plants in operation and under construction than any other country. Their great technical success is due mainly to the cooperation of consulting engineers, state sanitary engineers and city officials."

The operation of water purification plants is of great importance. A plant may be mechanically perfect, but that in itself will not assure a bacteriologically safe water, as past experience has shown. The prime essential is qualified supervision. Each development in water purification involves additional technical knowledge and skill. An experienced water works operator will produce a water satisfactory from a bacteriological standpoint, though the plant may not be mechanically perfect; while an inexperienced operator, even with a thoroughly modern plant, will not obtain as suitable a water. The public in too many instances has failed to learn that it receives huge dividends in added protection and saving from economical operation of a water works plant by a technically trained operator, and that such a well-qualified person is one of the best public investments. Is is this thought above all others which informed people should impress upon their communities to insure a water of suitable quality.

To those entrusted with preparing next year's City, County and State budgets an opportunity and a duty are presented by the unemployment emergency: an opportunity to obtain public improvements on unusually favorable terms and with a minimum of criticism by the taxpayers, and a duty to make immediate provision of sufficient work for all the unemployed among their citizens, so far as this is possible.

Water Supply, Sewage Treatment and Refuse Disposal in 1930

(Continued from page 27)

broad, fundamental lines by the conference of State Sanitary Engineers through its Committee on Sanitary Conservation of Water Resources.

The report of this committee, presented to the Public Health Engineering Section of the American Public Health Association at its fifty-eighth annual meeting, lays down the general basis for regulatory legislation covering sewage and industrial wastes pollution of streams and waterways and their pollution incidental to development of natural resources. The scope and purpose of statutory legislation and the general policies and plan of action best calculated to effect results are set forth in line with modern practice.

No agency exists more competent by reason of actual contact with the problem or better fitted to outline an effective program for each state to follow, and it is to be hoped and expected that the remedial action indicated by this report will be effectively placed before the various legislatures for their guidance in formulating and strengthening laws, the need for which is being acknowledged by all who are familiar with the problems involved.

The various state and regional sewage works associations throughout the country, many of which were organized last year, have been active in holding technical sessions and inspecting existing sewage treatment plants. In some states three or four meetings were held during the year. The success of such technical cooperation and the interest in the work of the associations evidenced by the large attendance and the general participation in activities by the members has proved the need of the clearing house for progressive ideas in design and operation thus established.

Official Control and Development.—One of the most definite advances in the control of sanitation and in the accomplishment of river cleaning in recent years has been the general adoption of the principle of sewer rentals and the enactment of statutes authorizing the levying of specific taxes for sewage treatment, which has been done in eight or ten states thus far. The first law authorizing sewer rentals or sewage treatment taxes was enacted by Ohio in 1923.

The principle is both rational and equitable and promises increasing correction of the futile practice of constructing sewage treatment works and then forgetting why they were built.

An increasing number of joint projects, sewerage district projects and metropolitan sewerage and sewage treatment arrangements are being planned or put in operation, as at Madison, Wis., Westchester County, N. Y., and at many other points.

Construction. — The construction of a bulkhead wall at the site of the new Ward's Island activated sludge sewage treatment plant for New York City has been commenced and it is expected that construction of the plant proper will begin in February, 1931. This plant will care for sewage from a population of more than 1,000,000. The estimated cost, including trunk sewers and siphon tunnels, is $34,000.000.

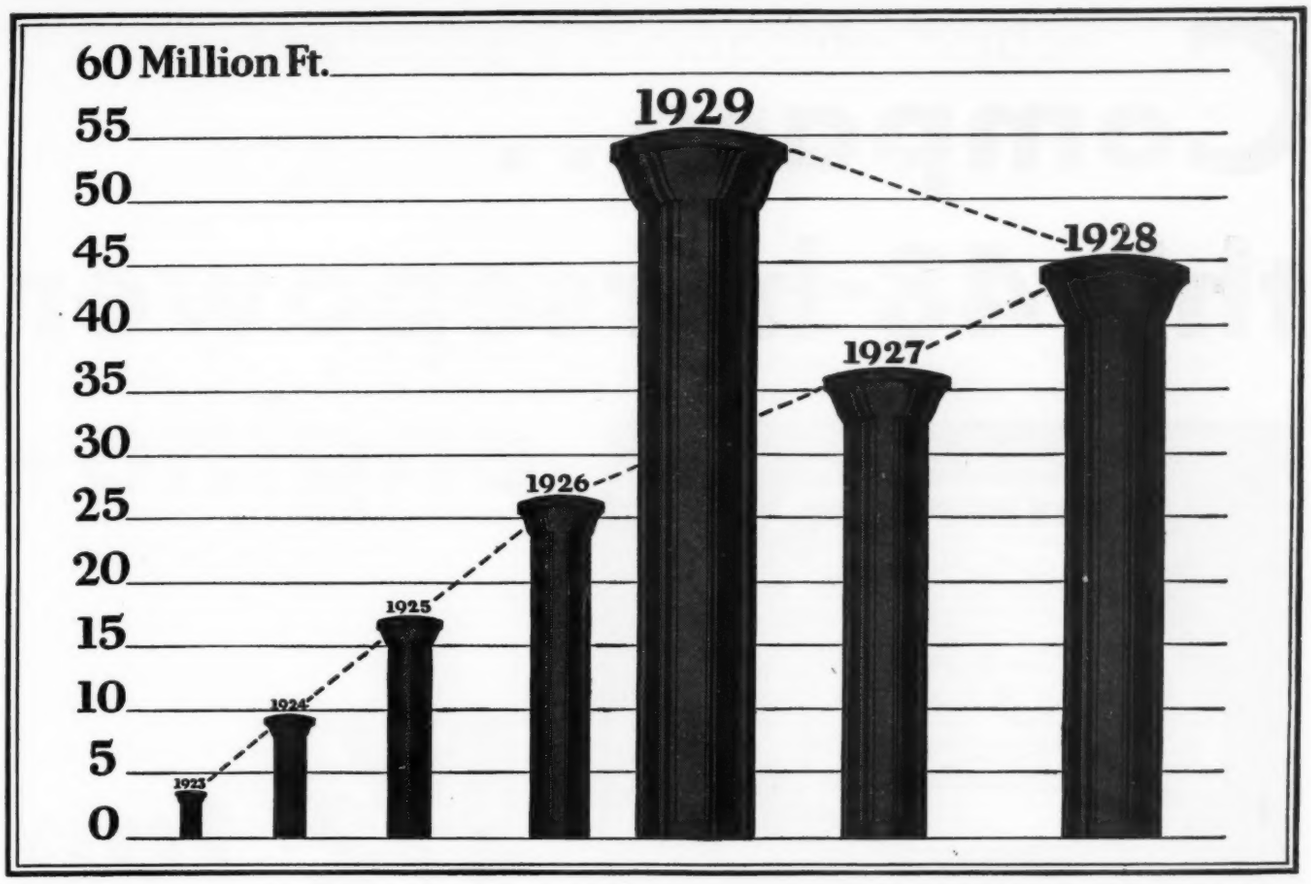
Among other proposed construction projects are the following:

New sewage treatment works for Columbus, O., are proposed.

At Buffalo, a report and cost estimate has been submitted recommending two sewage treatment works to serve the entire city. One plant suggested is an activated sludge plant for the southeastern part of the city with presedimentation and separate sludge digestion. It is recommended that the second plant to serve the northern portion of the city employ either sedimentation or fine screening, preferably sedimentation, with chlorination. The effluent from the first plant would be discharged into Lake Erie inside the breakwater and from the second plant into the Niagara river. The estimated cost of the entire work, including intercepting sewers, storm relief sewers and sewage treatment plants, is $23,000,000.

Developments in Processes.—Revision of the Standard Methods for the Examination of Water and

(Continued on page 69)



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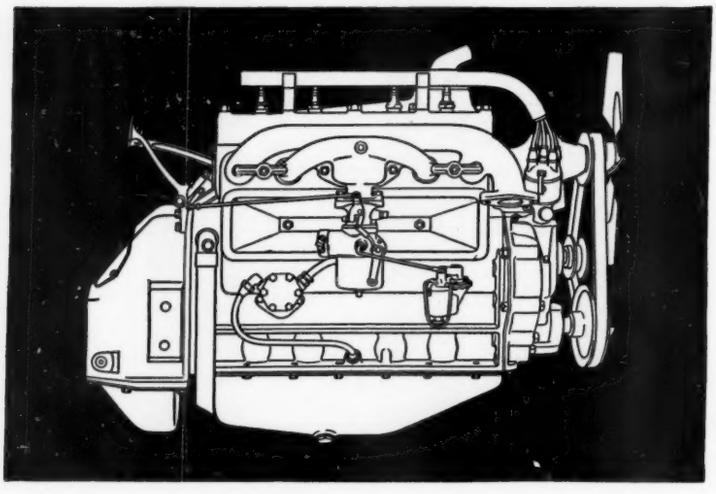
Compare . . this 48-horsepower engine—



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Designing a Composite Bridge

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By P. L. Brockway
City Engineer, Wichita, Kansas

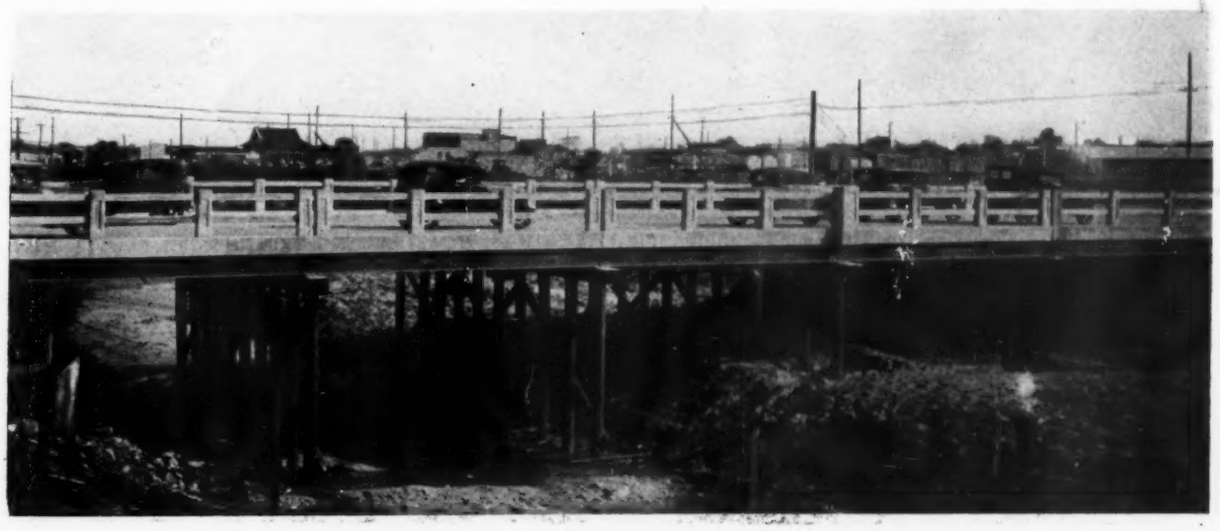
VARIOUS trade associations have built up high standards for their commodities, including dependable grading of special products for severe conditions of use. Those of interest to bridge designers include high-early-strength concrete, special steel alloys and special modifications of standard steel shapes especially adapted to the construction of certain type of bridges, and structural grades of timbers which are subjected to high stresses. Treatment of timber for long periods of protection against decay is also well standardized, and definite results are proven by many existing structures.

Some of the middle western states have adopted standard designs using treated lumber throughout, with various types of surfaces to protect the wood against traffic abrasion. These have been discussed from time to time in the technical press. They are especially useful in highways passing through sparsely settled country where stream beds are shallow and wide, requiring long, low bridges. Also, in many cities the number of necessary crossings imposes a heavy burden if all the bridges are built of the heavy, expensive types.

The City of Wichita, Kansas, is in this situation, cut by two rivers, one requiring bridges about four hundred fifty feet long and the other about two hundred fifty feet. In addition, there are some open canals sixty to one hundred feet wide. The foundation is uniformly water-bearing sand with underlying shale at about forty to fifty feet below the valley floor. Channels are twelve to twenty feet deep. The standard type of bridge formerly was reinforced concrete deck girders on gravity piers and abutments, in spans ranging from thirty to fifty-five feet. Such bridges built for thirty-ton moving loads on the roadway and with sidewalk and heavy concrete hand rails have cost from $3.50 to $4.50 per square foot of surface area, or $250 to $300 per linear foot of length. In these bridges the width is naturally made to somewhat anticipate future requirements because of the expense involved in widening.

Recently it was found that several bridges would be required at an early date, and designs were made, with tentative estimates, of alternate types. Structural grades of long leaf pine and Douglas fir were calculated at the strengths recommended by the West Coast Lumbermen's Association and by the Southern Pine Association which are in accord with the standards for Highway Drainage Structures adopted by the Bureau of Public Roads. Calculated for a live load of twenty tons according to standard methods, twenty-four-foot lengths of stringers were indicated as being most economical. In order to get full bearing on the caps, this made span lengths twenty-three feet center to center. Of the five bridges involved, one required nineteen such spans, another twelve spans, a third required six and one shorter odd span, and the other two required three spans each. This use of multiples of a common standard for all bridges obviously affected the prices bid. Roadway widths are likewise in fairly even multiples of five, being twenty-four feet, thirty feet and forty feet at the various sites. Three are provided with a sidewalk on one side, and all are so designed that sidewalks can be added by driving an extra row of piling at any time and extending out from the heavy hub rail, which will form an ordinary curb.

Piles are spaced on approximately five-foot centers under the roadways. Bids were invited on long leaf southern pine with twelve-pound treatment and on Douglas fir with ten-pound treatment. Freight rates seemed to give the pine sufficient advantage that all



View of completed bridge. Timber piles, steel beams and concrete floor.

bidders specified it in their bids. The piles were designed for a load of twenty-five tons each when driven to shale.

Caps were made fourteen inches square to provide proper bearing surface rather than because of structural need. Contract was let for Douglas fir of dense structural grade as defined in the grading rules No. 9 of the West Coast Lumbermen's Association. This also was in competition with southern long leaf pine, both to be treated with No. 1 creosote oil. Sway braces also were fir.

All timber assembly was by bolting, with all holes and cuts painted with oil but with no fabrication previous to treatment. Pile tops and caps are covered with galvanized sheet metal.

The really interesting part of the design and bidding was in the deck. Alternate bids were received using dense structural fir stringers 8" x 20", or long leaf close-grained southern pine 8" x 18", on two-foot centers; or 18", 54-pound special Cambria Section I beams on five foot centers. With steel beams the wider stringer spacing required a thicker concrete floor with more reinforcement, and stringer bearings required special plates on the caps.

The deck was specified to be reinforced concrete in either case, 7½ inches thick on the steel stringers and 5-6½-5 inches thick on the wood stringers.

The three low bids on all of the bridges combined are as follows:

	A	B	C
Using steel stringers.....	$64,390.00		$65,500.00
Using creosoted fir stringers..		$64,765.00	
Using creosoted pine stringers		$64,765.00	

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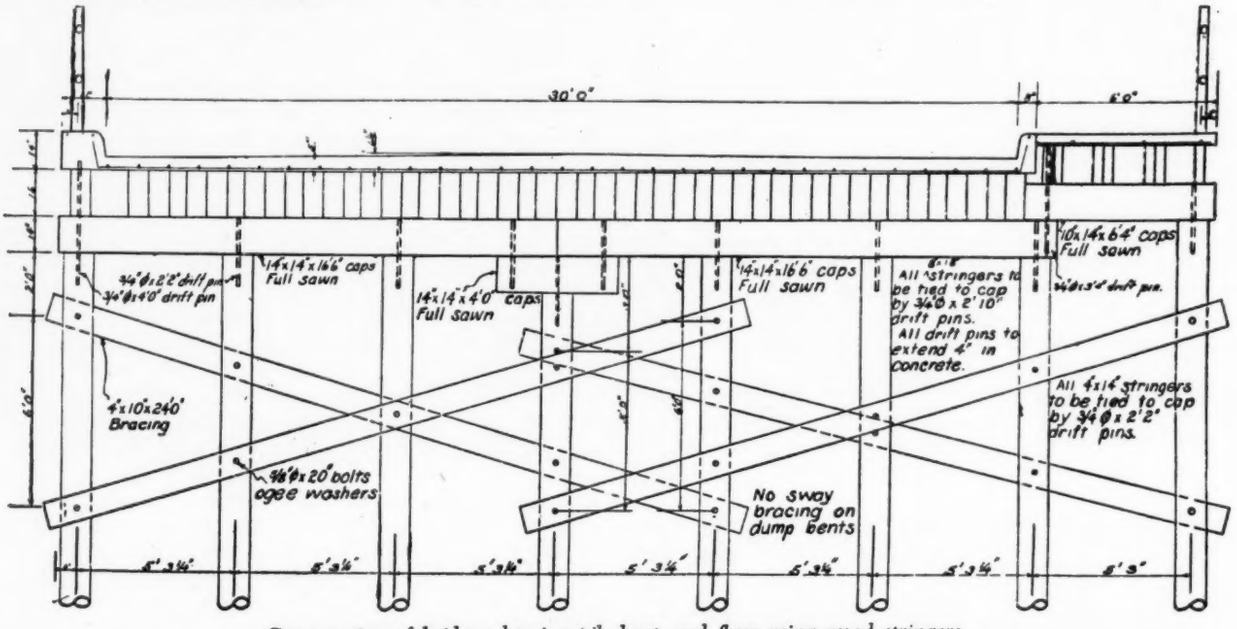

30'0"
6'0"
14"x14"x16'6" caps Full sawn
14"x14"x4'0" caps Full sawn
14"x14"x16'6" caps Full sawn
10"x14"x6'4" caps Full sawn
All stringers to be tied to cap by 3/4"Ø x 2'10" drift pins.
All drift pins to extend 4" in concrete.
All 4"x14" stringers to be tied to cap by 3/4"Ø x 2'2" drift pins.
4"x10"x24'0" Bracing
No sway bracing on dump bents
5'3¼"
5'3"

Cross-section of bridge, showing pile bent, and floor using wood stringers.

Pile bent assembly. Completion of floor follows close upon foundation.

CLETRAC

AT THE 1931 ROAD SHOW

A bigger, better and more elaborate show than ever before! A gigantic convention of a gigantic industry! Surely you'll attend this greatest of the year's industrial events.

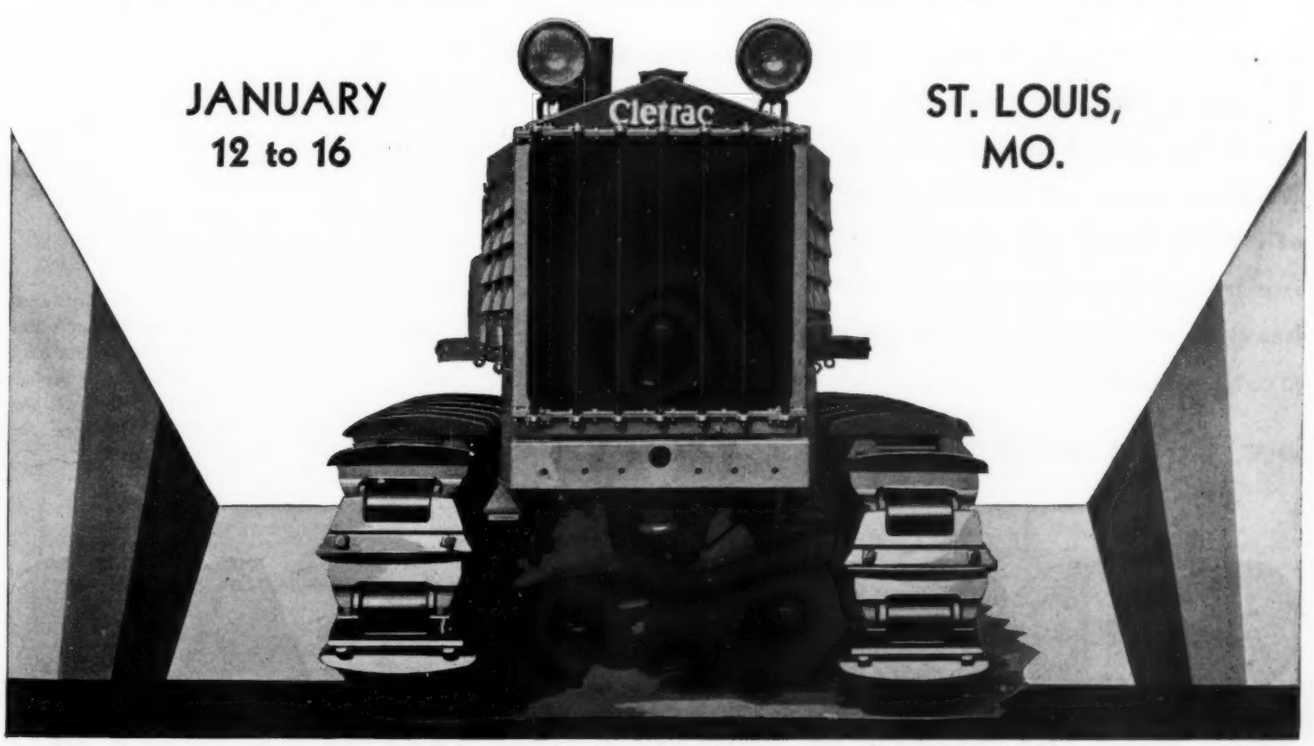
Cletrac extends to you this cordial invitation to visit its booth and hotel headquarters when attending the Show in St. Louis.

The Cletrac Line will be shown in Exhibition Building "A" in adjoining spaces Nos. 24 and 44. This will be one of the high spot exhibits of the Show. You will want to see it — and get first hand the really big facts about Cletrac's complete line of tractors for the road builder, contractor and general industrial user of tractor power.

THE CLEVELAND TRACTOR COMPANY, 19322 EUCLID AVE., CLEVELAND, OHIO

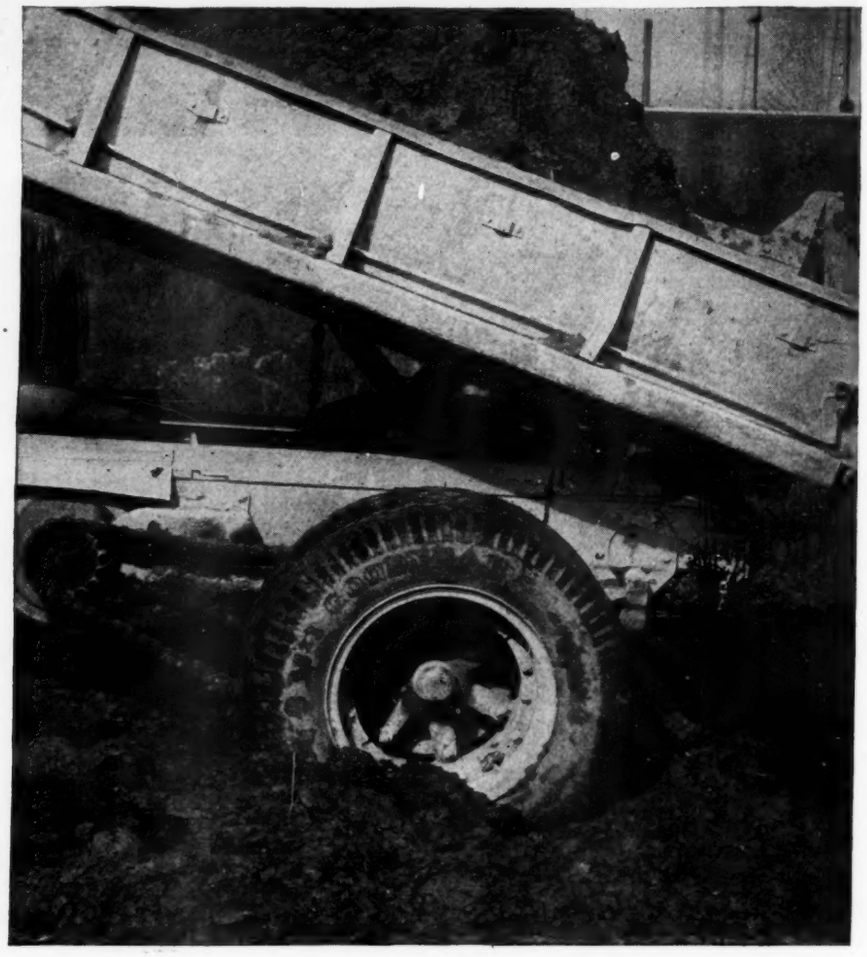
JANUARY
12 to 16

ST. LOUIS,
MO.



The *classified* INDUSTRIAL LITERATURE section is your guide to the latest catalogs—see page 93

The tires on this truck are Goodyear Dump Truck Pneumatics. It is one of a fleet of 23 operated by Penbrook Drayage and Supply Co., Inc., Harrisburg, Pa.



It'll pull out—

Those tires are Dump Truck Pneumatics

Goodyear builds the Dump Truck Pneumatic for just such jobs as this. It has a big, broad, husky All-Weather Tread—it has extra bars of rubber, heavy and wide, reaching up on the sidewalls. Under heavy loads, in soft ground, this great, stout tire walks your trucks on their way—keeps them moving, keeps them earning, and stands up under punishment.

What type of tires will help you most in state or county work? Ask the Goodyear Truck Tire Service Station Dealer. He has the right tire for every hauling duty.

The Goodyear Government Sales Department will gladly cooperate with County Highway officials to help them select the right type of tires for every hauling duty

ON YOUR NEW TRUCKS, SPECIFY GOODYEARS

GOODYEAR

MORE TONS ARE HAULED ON GOODYEAR TIRES THAN ON ANY OTHER KIND

Some of the bidders indicated that the actual cost of the steel is more but that their crews were steel men and could and would work more efficiently with those materials to which they were accustomed.

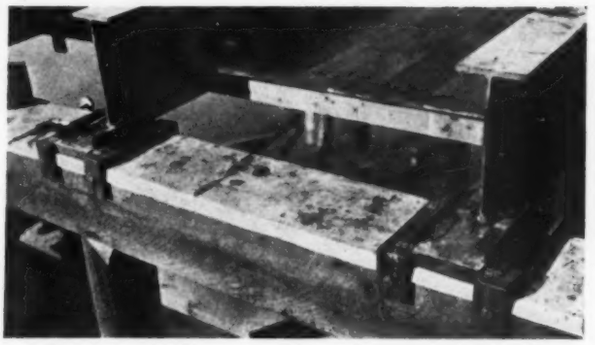
The contract was awarded to Whitney-Teeter, the low bidder, and the bridges are under construction using steel stringers.

Some interesting points have arisen as the work progressed. The piles are driven by a combination of jetting and drop hammer weighing twenty-four hundred pounds. They drive easily enough. No load tests have been made, but an attempt was made to pull one cut off too low. Two fifteen ton hydraulic jacks operated to full capacity and the full lifting power of the steam crane, probably not over five tons, failed to shake it.

The contractor bought the steel stringers in two-panel lengths. Being cut for butt joints with some allowance for expansion, the bents had to be accurately spaced. Ordinary wooden bridge construction permits strain to be put on the piles, pinning the whole structure together while under strain, if necessary. Individual piles in this contract are pulled or pushed into line, the jet used to relieve pressure in the right direction laterally and the sand allowed to settle back into place. Such good success is had by this method that subsequent fabrication consists simply in picking up the successive pieces and dropping them into place.

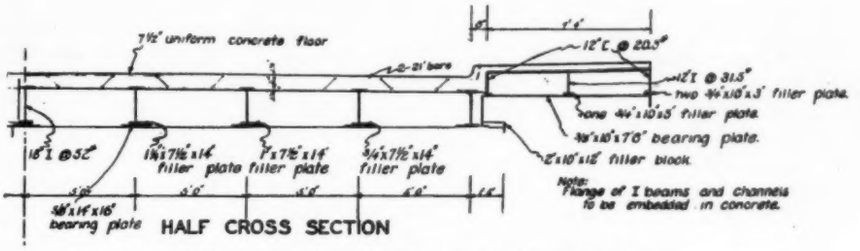
Caps are trimmed where necessary to provide even bearing for the bearing plates before the galvanized cover is placed. The plates are built up by welding angles on their upper surface, back to back with just enough space between them to receive the steel stringers. Crown in the pavement is obtained by using steel shims of successively greater thickness toward the center of the roadway under the stringers, the vertical legs of the angles being high enough to contain them as well as the lower flange of the stringers. Final bearing is on thin sheets of lead at each bearing. Short angles are welded on each corner of the bearing plate with one leg down. These prevent the plates from being shoved vertically off the caps. Holes are punched in the vertical leg of the angle and ¾-inch lag screws fasten them to the caps, preventing any slipping along the cap and holding the stringers to correct spacing. The only fabrication of any kind on the stringers is the welding of a plate, transversely across the bottom, just clearing the vertical legs of the bearing plates, to prevent the caps from shifting out from under the joints. All joints are expansion joints. These last plates are not placed until after erection.

In constructing the deck, the forms are made in convenient panels, placed under the upper flanges of the stringers and wedged up from the lower flanges. No nailing is required and they are used over and over again. In fact, it appears that enough forms for two double panels will handle the whole job.



Details of Expansion Joints.
Bearing plates with sheet lead under steel I beams.

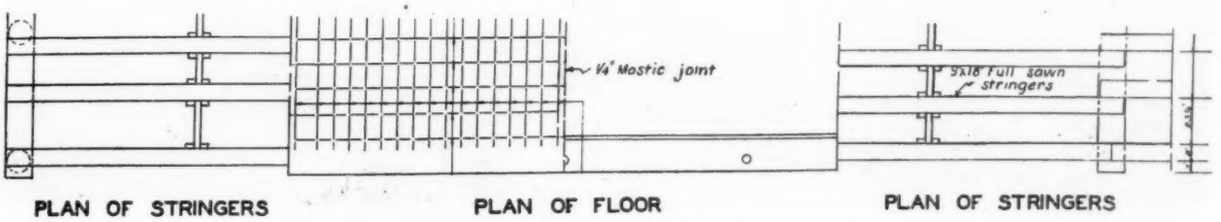
An interesting thing developed in alternates for the hand rails. Three types were designed for four of the bridges: The standard concrete rail used by the Kansas State Highway Commission, containing 0.7 cubic foot of concrete per foot of rail; the usual gas pipe rail with cast posts; and a galvanized structural steel rail. Bids were erratic on the alternates. The successful bidder went low on the concrete rail on the longer bridges and on the structural rail on the short ones. Cadmium plate was admitted on the structural rail at the request of the contractor as a substitute for galvanizing.



Half cross-section of bridge floor using steel beams.

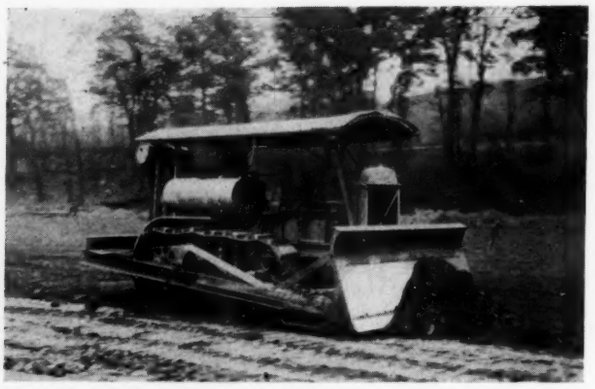
We believe that the bridges will have a reasonable life of not less than thirty years with a moderate amount of maintenance. It is perhaps pertinent to add that driftwood is not serious in flood stages, seldom running over twenty feet long.

The cost of the widest bridges, forty-foot roadway and one six-foot walk, is about $90 per foot or $2.00 per square foot. The narrowest bridge, twenty-four foot roadway with no walk, is slightly under $50 per foot or $2 per square foot. This compares favorably enough with the $3.50 to $4.50 per square foot already mentioned to be worthy of serious consideration in these days of heavy municipal capital expenditure. Citizens are expressing themselves as well pleased with the appearance of the bridges.



Plan of floor, reinforcement of same and stringers supporting it.

Crawler wagon dumping on fill.



Bulldozer knocking down fill.

Moving Dirt Economically on a Pennsylvania Highway Job

MUCH equipment and few men were employed by M. Bennet & Sons, contractors, on the grading work on a highway contract in Westmoreland County, Pa. A gas shovel loaded into crawler wagons, which worked on a haul of about 1,000 feet. The fill was knocked down with a bulldozer, and rolled. On this piece of the work, 8 men were employed, and somewhat better than 110 yards of earth per hour was moved. As a matter of fact, the haul was a little too long for the number of wagons used, and an additional one or two wagons could have been used with profit on this particular part of the work.

The three wagons used were a 10-yard Watson, and two 6½-yard Euclid, all equipped with crawler treads. The Watson was pulled with a Monarch "75" tractor, while Caterpillar "60" tractors were used on the Euclids. The shovel, which was a P & H No. 700 gas shovel with a 1¼-yard bucket, loaded these three wagons in somewhat less than 7 minutes, regularly, or at the rate of close to 200 cubic yards an hour, in favorable soil. The average time of loading was just under three minutes for the 10-yard Watson, and just under two minutes each for the Euclids.

On the haul of 1,000 feet or just a little more, the tractor-drawn wagons made a round trip in an average time of twelve minutes, though some trips were made in as little as ten minutes. It happened that this was close to the maximum haul expected, and that the average haul was not in excess of 500 or 600 feet, which accounted for the fact that enough equipment was not provided to keep the shovel busy at all times. From time to time, one or more motor trucks were run in as auxiliary equipment, but instead of being used to fill the vacant places in the crawler wagon schedule, they frequently were allowed to get in ahead of the wagons and keep them waiting for their load.

At the dump a LaPlant-Choate hydraulic bulldozer with a Caterpillar "60" tractor was used to keep the fill level, and a 10-ton Buffalo gas roller for compacting the fill.

There was one shovel operator, one man to keep cleaned up around the shovel, three tractor operators engaged in hauling the crawler wagons, one operator of the bulldozer and one of the roller, and one man in charge at the dump, spotting the loads and releasing the dump mechanism.

Gas shovel loading crawler wagons

YEAR 'ROUND...TOUGH GOING

You'll find FWD Trucks giving unmatched service

"Regard of service . . . the FWD is the greatest single power unit". This comes to us from the field. It comes from men who use them year after year. State and county highway officials tell us the same. They know FWD power and traction . . . its all year service.

In short . . . because the FWD drives and brakes on all four wheels and distributes the load and power to each of the four wheels . . . it is unmatched for pulling and hauling.

Twenty years of sound engineering and manufacturing based on close observation of FWD Trucks in the field reflect their benefits in the present line of FWD Trucks. There's no service too severe for the FWD. Tell us the nature of your work . . . let us master it with an FWD. Write for specific literature.

Drives through front and rear wheels, brakes on all four wheels.

Steers as easily as a pleasure car.

A general service truck which adapts itself to special needs and provides more than economical transportation.

Furnished in 2 to 10 ton sizes, including four wheel, six wheel and tractor trucks.

Manufactured by the oldest and largest manufacturer of four wheel drive trucks in the world.

Have increased in sales 1084% in the past eight years.

Received 62% of 1929 orders from owners of FWD Trucks.

THE FOUR WHEEL DRIVE AUTO CO., Clintonville, Wis.

Canadian Factory Kitchener, Ontario

BACKED BY FWD TRUCKS NATION-WIDE SERVICE

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△△△ Little Points that loom big later △△△

That *settles it!*

from now on we'll order COLUMBIANS △△△△

What kind of fire hydrants you put on your corners may not matter so much to the people in the next county but it makes all kinds of difference to your fire chief.

The owner of every store, every factory, every home looks to him for protection. *High pressure salesmanship* means nothing to him but *high pressure valves and hydrants* mean a lot. And he knows why *Columbians* give it to him!

...Why the Chief likes Columbians

The care and repair of fire hydrants is one of his responsibilities. The improved *Columbian* hydrant makes this easy for him — for all working parts can be removed, repaired and replaced in 30 minutes *without disturbing the hydrant barrel or digging up the pavement.*

He knows that *Columbian* carries a complete stock of repair parts . . . that all working parts are machined to three thousandths of an inch and checked to master steel dies . . . so that 10, 20 or 30 years from now he gets *Columbian* parts that fit easily and perfectly.

Columbian
IRON WORKS
CHATTANOOGA, TENNESSEE

Work Done by Hartford Water Board

Nearly four miles of large reinforced concrete pipe constructed and laid by contract. Chlorinating new mains. Cement-lined service pipe. Repairs to the Nepaug dam.

DURING 1929 the water commissioners of Hartford, Conn., built a line of pipe with a diameter varying from 42″ and 36″ and not subjected to internal pressures of more than a few pounds. Bids were received on five kinds of pipe—cast-iron lined with cement; three kinds of steel pipe, each lined with cement mortar and wrapped with burlap soaked with bitumen; and reinforced concrete pipe of the so-called cylinder construction. The contract included 16,925 ft. of 42-inch and 2,075 ft. of 36-inch. The lowest bid was that of the Lock Joint Pipe Co.—$17.15 per lineal foot for 42-inch reinforced concrete pipe and $16.30 for 36-inch; with about $45,000 additional for trench excavation, masonry, gates and other items; giving a total of $369,204.

The contract was awarded in July and by September the manufacture of pipes was well under way at a plant set up by the contractor on Oakwood Ave. near the main line of the New Haven Railroad. The work is described by Caleb Mills Saville in his annual report as follows:

"Considerable difficulty was experienced in getting suitable sand for making of the pipe, and throughout the manufacturing period experiments were carried on to find some combination of materials and methods that would give a more perfect product than was being obtained. However, the pipe as made rated as "fair" and probably, considering the very large amount of steel around which the concrete had to be poured, was as good as could be produced. In the manufacture of the pipe, the steel cylinders were fabricated and tested under 25 lb. air pressure and the joint rings were then welded on at each end. The outer reinforcing cage was fabricated by forming the circumferential rings, electric welding them, and, after testing each one nearly to the elastic limit of the steel, assembling the rings on horizontal spacing bars. The inner reinforcing consisted of triangle mesh tack welded to the inner surface of the steel cylinder. The cylinder and reinforcing cage was then assembled in vertical steel forms, and wet concrete, about a 1:2:3 mix, was poured and carefully spaded and puddled so as to cover the steel as thoroughly as possible. Mechanical vibrators were tried but the results obtained by their use were no better than from hand manipulation. The pipes were poured in groups of from twenty-five to thirty-six pipe per group, each group in a woden roofless compartment or "room." After pouring, the pipe was cured in live steam, the forms stripped the day after pouring, the pipe cleaned and chipped and then stored horizontally on yard skids. While in storage, the joint rings were painted and any necessary patching done. For specials, the steel cylinder and reinforcing were fabricated as for straight pipe, but instead of being placed in a form and the concrete poured, the specials which were curved, such as bends, were plastered on the inside, and the exterior concrete placed as a monolith in the trench after the special had been placed in the line.

"The manufacture of pipe was completed in December and the contractor began to dismantle his plant and ship it away.

"All cement used on this job was sampled and tested at the mill by the R. W. Hunt Co. and at the job by representatives of this department. A total of 49 carloads was delivered to the job.

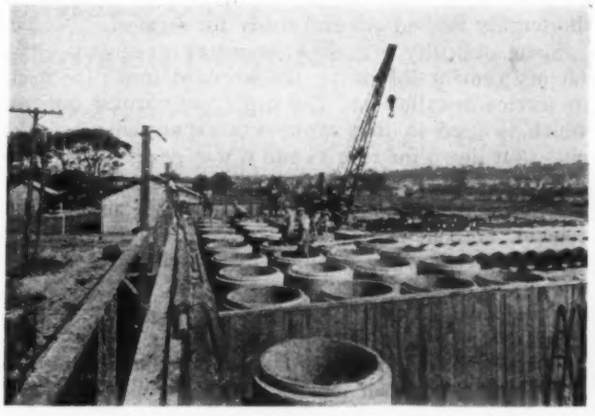
"The Water Board tests were conducted in a temporary laboratory fitted up in the Pilgard Building. The results obtained were in all cases well above contract requirements and the following table gives a brief comparison of results obtained from Water Board tests and those of R. W. Hunt Co.

	7 Day Tests Specification Requirement 225 lbs. per sq. in.		28 Day Tests Specification Requirement 325 lbs. per sq. in.	
Brand of Cement	Water Board	R. W. Hunt Co.	Water Board	R. W. Hunt Co.
Atlas	290.9 (15)*	325.5 (12)	375.1 (20)	457.9 (12)
Nazareth	338.4 (145)	369.9 (122)	430.7 (144)	466.3 (119)
Total	333.9 (160)	365.6 (134)	423.9 (164)	465.5 (131)

*Figures in parenthesis indicate number of tests made.

"Pipe was delivered along the trench line by auto truck carying one and sometimes two pipes to a load. Distribution of pipe was started on October 14, beginning on Ridgewod Road.

"Pipe laying was started at Ridgewod Road and the Boulevard on October 21st and a second crew started



Above—portion of contractor's plant.
Below—Machine used for trenching and laying concrete pipe.

laying at Oakwod Ave. and Thomas Street on October 25th. Each crew was equipped with a 'Northwest' gas-driven trench hoe for digging the trench and handling the pipe, one to three trucks for handling backfill, an air compressor for rock work and for tamping backfill, and a trench pump. Only a short length of trench was kept open and the trucks were used for consolidating the backfill as well as for handling the excavated material. Gas and water services were dug up ahead of the shovel, the piece across the trench cut out, and a temporary service consisting of a length of hose put in. As soon as the digger passed a service, the hose was reconnected across the trench, and as soon as the backfill was in place the service was repiped. In certain sections of the line, sewer laterals had to be relocated and in some places new sewers were built. All of the sewer work was done by the contractor's force under the inspection of the town's sewer department. While work was being done in State highways, an inspector from that department was on the job at all times."

Chlorination of Mains

A portable Wallace & Tiernan chlorinator or main sterilizer was added to the department equipment during the year. It is proposed to sterilize all new mains twelve inches and larger in size as well as long lengths of smaller sized mains. The outfit was successfully used on a 16-inch transmission main and on a long line of 8 and 12-inch pipe.

Briefly, the method of sterilizing a new main is as follows: Chlorine gas is introduced directly into the main through a corporation cock at one end of the section under test, a steady flow of water is maintained throughout the section and the tests for free chlorine are made at the far end of the section. When a positive chlorine test is secured the section is shut off from the rest of the line and allowed to stand for an hour or so, full of chlorinated water. It is then thoroughly flushed out and ready for service.

Some difficulty was experienced in getting a satisfactory cement for lining the wrought iron pipe used in service installations. The supply of natural cement, which is used in this work, was exhausted when the mill shut down for repairs and it was necessary to look for a substitute. A special high test cement, Portland Cement, mixtures of the two and mixtures of Portland cement and hydrated lime, were all tried. Good results were finally obtained using the last combination.

Repairs to Nepaug dam were made by the National Gunite Contracting Company. The job consisted in placing "Gunite" on the upstream portion of the spillway section between the water surface and the crest, and on the three sides of the upstream gate chamber between the water surface and the coping, and was done at this time because of the low stage of the reservoir. The contractor's plant, consisting of an air compressor and grouting machine, together with the necessary hose, chipping hammers, cement bins, etc., was shipped in and set up, and on October 2nd actual work on the dam was started. First the loose material was chipped off and then holes on about three-foot centers were drilled and in them expansion bolts were fastened. A layer of mesh was then wired to the bolts, wooden strips installed at the edges and angles of the work and then the gunite placed for a thickness of from one to two inches. The shooting of the gunite was started on the 10th of October and practically completed by the 16th. After the work covered by the contract had been completed, it was decided to have several of the arch keystones repaired, as well as some of the holes in the sidewalk and parapet on the downstream side.

Effect of Chlorine on Fish

German tests indicate that 0.3 to 1.0 p.p.m. of free chlorine in water kills most kinds of fish. Chlorinated sewage effluents with dilution of less than 4 to 1 in the receiving stream should therefore not show more than 1 p.p.m. of free chlorine if preservation of fish life is desired.

Don't undermine the self-respect of your unemployed by charity—give them work on public improvements.

Machinery for Sewer Work in Worcester, Mass.

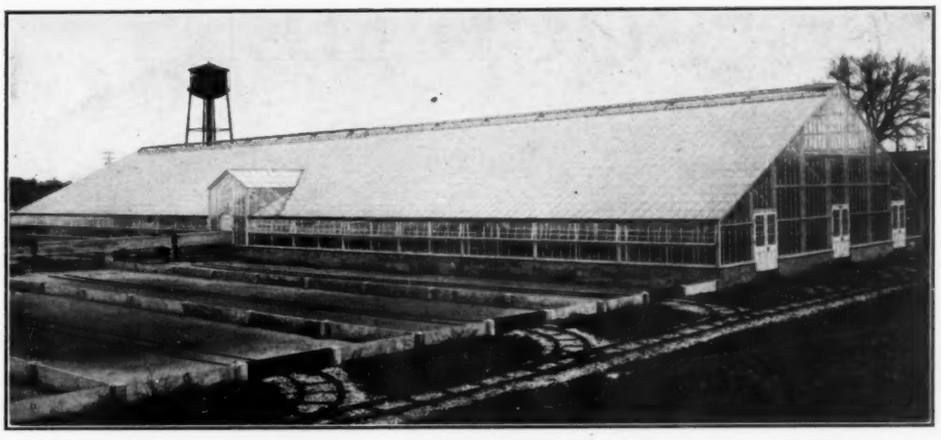
DURING the year 1929 the sewer department of Worcester, Mass., constructed 16.29 miles of sewers of sizes up to 6 feet diameter, using modern machinery and methods. The maximum number of men employed (during the week ending July 12) was 344, and the minimum (during February) was 238. The minimum wage paid adult laborers was $4.64 for eight hours. The total amount spent on this sewer construction was about $720,000.

Said John H. Brooks, Jr., superintendent of sewers, in his annual report: "Our machinery has been maintained in a high state of efficiency and has been constantly in operation. We have at present one 1-yard P & H shovel, two ½-yard Speeder shovels, one Type A Erie shovel and one Parsons trench excavator, two Fordson Backfillers and one P & H Backfiller. Our excavating equipment is thoroughly mobile due to the use of trailers. It is common practice to transfer shovels from one job to another, thus enabling the excavation to be carried forward with a minimum of delay. Our practice is to excavate the trench to a depth so that there is a minimum amount of hand work left for the construction gang. In ordinary soil, the shovel can advance much faster than the pipe laying. It is, therefore, possible to open up a considerable length of ditch with the machine, and move the shovel to another location where it can operate until required again at the original job.

"We are well equipped with pneumatic spades, paving breakers and drills, with the necessary compressors to operate them. We have two 9 by 8 compressors, three 5½ by 5 compressors, all mounted on wheels and easily moved from one job to another by motor truck. We also have a 5½ by 5 compressor mounted on Type AA Ford Chassis which is available for all emergency needs.

"The catch basin machines have handled 12,728 cubic feet of material at a cost of $2.06 including the cost of hauling to the dump. Our sewer system now has 4,929 catch basins, all of which have been cleaned an average of three times. It is our practice to clean all basins once in the spring and late fall. Others are cleaned from time to time as their condition warrants. The department has made use of small power-dump trucks more extensively this year in preference to the horse-drawn wagon. There is less complaint from congestion on our streets and less loss of time going to the dump. This problem of hauling is becoming more important as the city develops."

Master Construction Glass-Overs for Sludge Beds



Taylor & Woltmann, Engineers; J. E. Simmons, General Contractor; Stanley Pinel, Resident Engineer on construction work. Lord and Burnham supplied and erected the Sludge Bed Glass-Overs.

54,000 Capacity Sludge Bed Glass-Over Operating for Bloomington, Ill.

This Sewage Disposal Plant was designed to serve a population of 54,000.

Here is the engineers' statement about the Glass-Overs:

"THE under glass drying bed is 87 feet wide and 188 feet long. The sides are 7½ feet and the ridge 24 feet high. The framework is steel of Lord and Burnham's Master Construction. All wood is best of cypress. The superintendent in direct charge is aided by three men, each on 8 hour shifts. Two extra helpers are also on during the day. This Plant takes care of both Bloomington and Normal."

To which let us add, we will be glad to send you a reprint article from Engineering News Record which gives full details. Likewise, by way of evidence, a list of our Glass-Over installations.

Lord & Burnham Co.

Sludge Bed Glass-Overs

Graybar Bldg. New York | 208 S. La Salle St. Chicago | Harbor Com. Bldg. Toronto

Branch Offices: Boston, Philadelphia, Irvington, Denver, Detroit, Cleveland, Buffalo, Kansas City, Greensboro, St. Louis, Montreal, St. Catharines.

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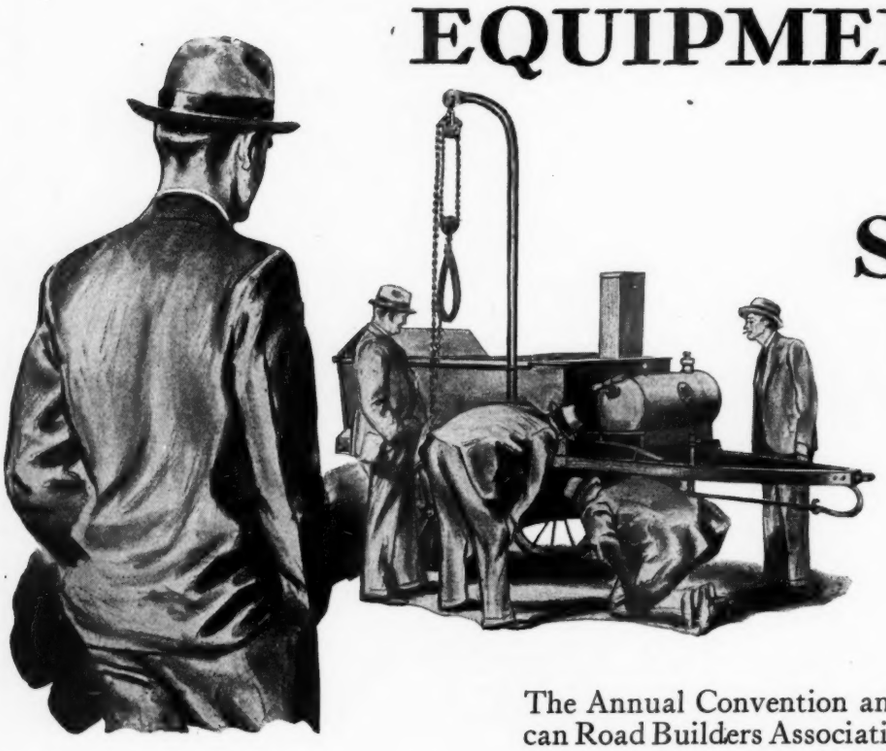
You will want to see...

LITTLEFORD
ROAD MAINTENANCE EQUIPMENT



at the ST. LOUIS SHOW
Jan 10 to 16

Asphalt Kettles
(Oil and Wood Burning)
Asphalt and Emulsion Sprayers
Tool Boxes
Tool Heaters and Surface Heaters
Water Heaters and Concrete Heaters
Steel Mortar Boxes
Salamanders
Joint Fillers
Squeegee Machines
Tools and Pots
Traffic Line Markers
Grout and Mastic Mixers

The Annual Convention and Road Show of the American Road Builders Association is an event looked forward to by everyone engaged in highway work. It is a vacation and an education combined.

In just a few weeks many of you will be heading for St. Louis. When you get there, we want you to keep your weather eye peeled for the large LB Sign of a Good Heater that marks the Littleford booth. There will be new equipment that we want you to see. We're not saying a word about it now, because we intend to surprise you!

By the way, it would be a good idea to look over our catalog before you go to the show. Have you a copy handy? If not, fill out the coupon and mail it. We'll send the catalog by return mail.

Littleford Bros.
452 E. Pearl St.
Cincinnati, Ohio

Gentlemen:

Without obligation to me, send your complete catalog showing Littleford Road Maintenance Equipment.

Name .....
Title .....
Street Address .....
City ..... *State* .....

P. W. 12-30

THE SIGN OF A GOOD HEATER — LB — LITTLEFORD BROS. CINCINNATI, OHIO

LITTLEFORD
Road Maintenance Equipment
SINCE 1900

LITTLEFORD BROS. 452 E. PEARL ST. CINCINNATI, O.

Reg. U. S. Pat. Off.

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Measurement and Control of Municipal Sanitation

Conclusion of synopsis of report of Committee on Uniform Street Sanitation Records. Application of the units recommended and factors to be considered. Purpose of cost accounting

IN our November issue we gave a synopsis of that part of a report by the Committee on Uniform Street Sanitation Records of the International Association of Public Works Officials in which was explained the need of measurement standards in connection with street cleaning and refuse removal and disposal, and the work units recommended for use. We conclude the synopsis of the report in this issue, with a discussion of the reasons for and application of the units recommended.

Street Cleaning

This includes the cleaning, by any means, of paved streets, alleys, sidewalks or other public ways, and removing the material.

The "curb mile" indicates cleaning half of the street parallel to one curb, including intersections, for a distance of one mile. Cleaning the full width of any street, regardless of width, for a length of one mile represents two curb-miles of cleaning.

"Although the mile unit would give about as accurate results as the curb-mile unit, the curb-mile seems preferable because it is related more closely to the way the work is done; since under present pavement and traffic conditions, the cleaning of streets has become largely a matter of cleaning the gutter.

"The curb-mile unit is not appropriate for cleaning alleys or lanes. Straight miles should be employed where this sort of cleaning is done."

"The curb-mile unit is applied to hand brooming, hand flushing or white wing cleaning. Hand cleaning should not be treated separately unless it represents a separate cleaning of the streets without the aid of any machines. Although the white wing will pick up deposits in the middle of the street, the work is primarily along the curb. In cases where the white wing patrols the same route day in and day out he should be given credit for the curb miles actually cleaned, whether only part of the route is cleaned or the complete route is cleaned more than once. Where the routes vary from day to day for each man or crew, credit is likewise given for the curb miles of streets actually cleaned."

Where machine flushing is used, a curb-mile represents the flushing plus hand brooming or any other supplementary method used between the center of the street and the curb. Where the entire width of roadway is cleaned in one passage of the flusher, one mile of travel of the flusher gives two curb-miles of cleaning. "The varying amount of work required by different widths of streets is adjusted in the reports by grouping the streets according to the number of passages. Separate records should be kept for straight flushing and for each distinct combination of machine flusher cleaning, i.e., flushing with hand brooming, flushing with machine sweeping, and flushing with hand flushing. The records should show the amount of work and cost of each operation under each combination."

"Unfortunately, there is no yardstick which will measure the relative cleanliness of streets. . . . Information concerning the width of streets, frequency of cleaning, amount of water consumed, type of pavement, character of refuse on streets, length of haul for disposal of sweepings, and other similar factors must be taken into consideration. The type and condition of the pavement largely determines the method or equipment which is most suitable."

The following indicates the various factors to be considered in comparing operations within a city or between several cities.

I. FACTORS SUBJECT TO GOVERNMENTAL CONTROL
   - A. *Factors within the control of the street cleaning unit*
     1. Plan of operations and procedure
     2. Time of doing the work (to a limited extent only, for traffic conditions may govern)
     3. Methods and equipment used (to a limited extent; for the type, width, and grade of pavement; climate; and other conditions may govern)
   - B. *Factors outside the control of the street cleaning unit*
     1. Type of pavement and state of repairs
     2. Character and amount of traffic
     3. Type of district, wholesale, retail, residence, etc.
     4. Character of street refuse
     5. Paved or unpaved condition of intersecting streets
     6. Character and density of population adjacent to streets
     7. Kind and number of trees adjacent to streets
     8. Legislation governing the sweeping and dumping of refuse on to the streets and the enforcement thereof
     9. Standard of cleanliness desired
     10. Local wage scale (to a limited extent)

II. FACTORS NOT SUBJECT TO GOVERNMENTAL CONTROL
   1. Climatic conditions (snowfall, rainfall, and temperature)
   2. Grade of streets (to a limited extent only)

Snow Removal

This includes plowing, or removal by hauling or chemical treatment of snow or ice. The unit for plowing streets, alleys or sidewalks is the lineal mile actually travelled by the plow. A mile of street may require several miles of plowing. For use of chemicals, the mile of street is used, with information concerning width, quantity of chemical used, depth of snow and temperature to complete the picture.

For removal, the cubic yard is the unit, whether snow or ice is loaded by hand or machine. Hand and machine loading should be kept separate to permit comparing the relative costs.

Amount of snowfall, rapidity of melting, character of snow, wind, temperature, traffic, length of haul, place of disposal—all affect the problem, and comparisons are difficult, even within a given city. But records of these factors and the amount of effort applied should be studied in planning future operations and budget requirements.

Refuse Removal

This includes collecting, loading and transporting to the point of ultimate disposal, all city refuse.

The unit is the ton. "Although the cost of a weighing machine may seem burdensome, it is really a very small item when compared to the economies which can be effected through reliable work and cost analyses."

Where weighing is impossible, estimates of yardage are much more reliable than of weight.

The amount should be obtained separately for each class of refuse collected.

Also separate records should be made for each method of removal—direct haul to disposal point, truck and trailer, barging or other supplementary transportation; for each distinct stage in transportation; and for household separate from commercial service.

Other factors to be considered are the number of households served; number of collections daily on each route; number of complaints.

In analyzing the performance of a collection unit, consider the length of collection route and of haul, density of population; number, size and type of collection units and number of men to a unit.

The factors to be studied in comparing removal operations within a city or between cities are:

I. FACTORS SUBJECT TO GOVERNMENTAL CONTROL
- A. *Factors within the control of the removal unit*
  1. Plan of operations and procedure
  2. Methods and equipment used (to a limited extent, for grade and conditions of pavement and degree of separation of different classes of refuse may govern)
  3. Policy of transferring refuse between point of collection and delivery point
- B. *Factors outside the control of refuse removal unit*
  1. Haulage distance—availability of disposal sites
  2. Quantity of refuse at points of collection
  3. Type and capacity of containers
  4. Whether house refuse is collected from curb or from premises
  5. Degree of separation of different classes of refuse
  6. Extent and condition of pavement
  7. Density of traffic over haulage route
  8. Standard of cleanliness observed in collection and hauling
  9. Local wage scale (to a limited extent)
  10. Breakdown of disposal plant

II. FACTORS NOT SUBJECT TO GOVERNMENTAL CONTROL
1. Climatic conditions (snowfall, rainfall, and temperature)
2. Grade of streets (to a limited extent)
3. Distance refuse must be hauled to point of disposal (to a limited extent only)
4. Extent to which alley collection is possible
5. Density of population

Refuse Disposal

This means the ultimate disposal of all municipal refuse. The units are the same as in collection. Separate records should be kept of each type of refuse under each distinct method, and show amount disposed of at each point. In the case of incineration or reduction plants, other factors to be recorded are analyses of composition, amount of ash or by-product, of fuel or outside power used, etc.

Factors to be considered are classified as follows:

I. FACTORS SUBJECT TO GOVERNMENTAL CONTROL
- A. *Factors within the control of the refuse disposal unit*
  1. Plan of operations
  2. Type of plant or equipment (other governmental agencies or availability of disposal sites may govern)
- B. *Factors outside the control of the refuse disposal unit*
  1. Degree of necessity for suppressing odors
  2. Proportion of different classes of refuse
  3. Local wage rates (to a limited extent)
  4. Cooperation by the refuse removal unit

II. FACTORS NOT SUBJECT TO GOVERNMENTAL CONTROL
1. Weather conditions (rain, snow, temperature)
2. Seasonal variations affecting composition or quantity of refuse
3. Physical characteristics of city which may partly determine location and nature of disposal works

Catch Basin Cleaning

Includes removal and disposal by whatever methods; also thawing or removing obstructions. Size of basins and number of cleanings should be recorded, and separate records kept for hand and machine cleaning. Affecting conditions are: Size and type of basins, capacity of sewers, grade of streets, amount of rain and snow fall, and character of refuse removed.

Cost Accounting

The report contains nine pages of discussion of forms and procedure employed in cost accounting, to which space permits only brief reference. "In its final form, Part III will serve as a records and accounting manual to guide cities in future installations or revisions."

The matter is presented under the headings: "Records and Accounting Requirements"; "Elements of Cost and Their Control"; "Time and Performance Reports"; and "Assembling and Presenting of Administrative Reports."

"If these various types of records are to be properly coordinated and assembled in such a manner as will form a basis for official action, they must be placed in the hands of a well-organized records bureau or, in small cities, of a competent records and cost clerk. This bureau or cost clerk thereby becomes the main staff agency of the sanitation official with the primary duty of furnishing information for his guidance. Occupying this important place in sanitation management, the staff should be thoroughly familiar with all sanitation operations and well trained in the basic principles of cost accounting."

"The keynote of cost accounting is the control of expense. Any figures that do not carry some measure of control or guide future planning are not worth the trouble and cost of compiling."

Winter Operation of Sewage Treatment Works

Daily attention is essential to the proper operation of sewage treatment plants during cold weather. Without it considerable damage may result to the plant.

Sludge should be removed promptly from the settling tanks and, as soon as properly dried, from the beds.

Adequate precautions should be taken to protect all sewer, water and sludge lines from freezing.

Auxiliary pumping equipment should be placed in operating condition to meet any emergency resulting from the failure of the usual power sources.

Heat should be provided in plants where there is chlorination equipment in order to prevent so-called "freezing" of the chlorinating apparatus and to insure continuous sterilization of the plant effluent.

The proper tools and implements should be available to the plant operator in order to facilitate proper winter operation.

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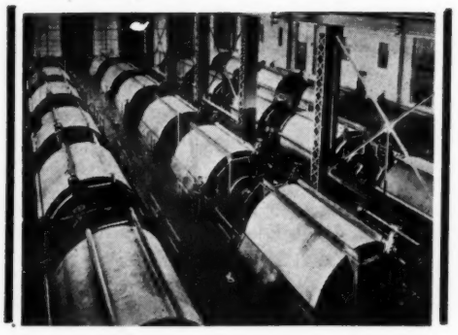

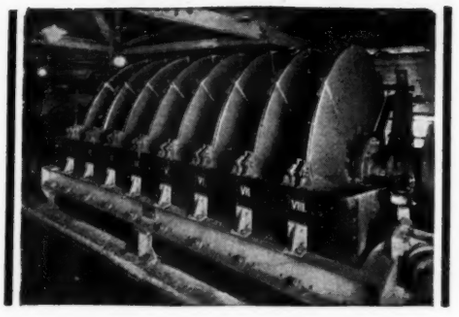

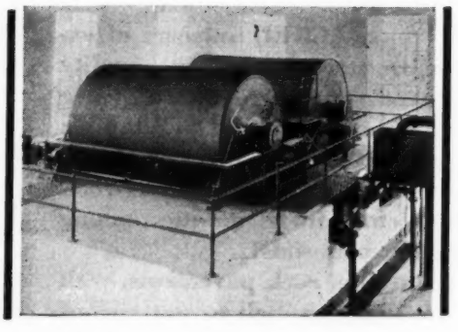

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RECENT LEGAL DECISIONS

By John Simpson

SEWERAGE

Sewers as Local Improvements

The construction of a sewer in a street benefiting only an immediate section of the street where the sewer is built is, it is held, McCollom v. City of Lockport, 135 Misc. 555, 239 N. Y. S. 83 (Supreme Court, Niagara County, New York), a local improvement to be paid for by assessment on the realty benefited, under the provisions of the Lockport charter, and not a general improvement, to be made a charge against the city at large. A sewer built to replace an inadequate sewer of this kind is a local improvement. The fact that the city in building the original sewer, fell into error in not making it sufficiently large to meet the requirements of the present time incident to the growth of the city, would not justify assessment of the cost on the city at large. The court quoted from Northwestern University v. Village of Wilmette, 230 Ill. 80, 82 N. E. 615, as follows: "A 'local improvement' is a public improvement which through its being confined to a locality enhances the value of adjacent property, as distinguished from benefits diffused by it throughout the municipality, and though a system of sewers to relieve the congested condition of existing sewers by furnishing additional means whereby the surface water caused by excessive rain may be carried away, may benefit all the property in a village, if the improvement will specially enhance the adjacent property, it is local and may be paid for by special assessment."

Damage from Clogged Sewer Used Before Street Is Paved

A city let a contract to lay sewers along and pave a street. The sewers were laid first and an abutting owner installed his sewerage lines and connected up with the sewer. Two months after, as a result of the cover on a manhole being displaced and some bricks removed, the sewer became choked and the owner's residence was flooded. The paving had never been done. The sewer had not been inspected and accepted by the city, but it remained in the possession and control of the contractor as part of the unfinished project. The Alabama Supreme Court held, Sisco v. City of Huntsville, 124 So. 95, that the city was not liable for the damage. The contractor was not liable, being under no duty to operate the sewer or maintain it for use. His duties were those incident to construction under his contract. The city engineer was not liable by mere acquiescence in the owner's premature use of the sewer, assumed voluntarily and at the owner's own risk.

City's Liability for Inadequate Sewer

The Washington Supreme Court holds, Boyer v. City of Tacoma, 286 Pac. 659, that where a main sewer had become inadequate, the city was liable for damage suffered by owners because of the clogging of the main sewer and the discharge of sewage on their property, where they were compelled by ordinance to connect with the sewer. At the time of its installation the sewer was of ample size to serve all the residents in the vicinity which it was expected to serve; but because of the growth of the territory it had become inadequate. While there probably were rather heavy rains at the times when the owner's basement was actually flooded, no extraordinary storm conditions were found to exist.

Invalid Sewer Assessment—City's Liability

The Indiana statute authorizes assessments for local sewers only against the abutting property, and an attempted assessment against property not abutting on the local sewer is wholly invalid. Under Acts 1909, c. 172, p. 412 (Burns' Ann. St. 1926 section 10448) it is expressly provided that "any difference between the amount so assessed and the contract price shall be paid by said city in cash out of its general fund," and an assignee of the contractor may recover against the city for such difference. City of Bloomington v. W. McDaniel (Ind. App.) 168 N. E. 187.

CONTRACTS AND CONTRACTORS

Damages for Breach of Construction Contract

Where a construction contract has been breached by refusal of the other party further to perform, the rule for damages is set forth in United States v. Behan, 110 U. S. 338, as follows:

"If the breach consists in preventing the performance of the contract, without the fault of the other party, who is willing to perform it, the loss of the latter will consist of two distinct items or grounds of damage, namely,—First, what he has already expended towards performance (less the value of materials on hand); secondly, the profits that he would realize by performing the whole contract. The second item, profits, cannot always be recovered. They may be too remote and speculative in their character, and therefore incapable of that clear and direct proof which the law requires."

This rule was applied in White River Levee Dist. v. McWilliams Dredging Co., 40 Fed. (2d) 873, an action by a dredging contractor against a levee district for damages arising from breach of a contract to construct a system of ditches for the district.

Release of Claims Against Paving Contractor

An action against a contractor employed by a syndicate for street improvement work and against a member of the syndicate for fraud and collusion resulting in the contractor being overpaid and enabling him to furnish inferior materials was settled by the contractor's payment of a stipulated sum and the execution of a release by the syndicate acknowledging payment in full of all claims or demands of every kind arising out of matters set forth therein. Before this settlement and release cracks had begun to appear shortly after the work was done along the line between the curb and the concrete pavement. After the settlement was made the city authorities refused to accept the work until the cracks were filled with asphalt. This the contractor failed to do and the syndicate's successor had to employ another contractor to do the work. For the cost of this, it claimed against the contractor's bankrupt estate. The Circuit Court of Appeals, Ninth Circuit, In re Riverpoll,

38 F. (2d) 205, disallowed the claim, holding it was covered by the release, regardless of whether the parties thereto had in mind the deficiencies in performance which either led to, or resulted from, the cracks in the pavement, or whether the claim for breach of the contract was fully known to the parties at the time of the settlement or became known by the subsequent deterioration or defect in the work.

Contract With Contractor in Default

Section 419 of Greater New York Charter provides that no bid shall be accepted from, or contract awarded to, any person who is in arrears to the City of New York upon debt or contract, or who is a defaulter, as surety or otherwise, upon any obligation to the City. This provision is applicable to contracts with the board of education. Those seeking to deal with a municipal corporation through its officials must take great care to learn the nature and extent of their authority. A contractor, it is held, should know that he cannot enter into a second contract with the city while in default on an earlier contract. Such a contract is not made valid by the subsequent payment by the contractor's surety of his indebtedness on the first contract.—Henschel v. City of New York, 243 N. Y. S. 362.

Action Against Surety on Special Contract for Completion

A bridge company agreed with a highway contractor to build certain bridges on a state highway. On the highway contractor's failure to comply with its contract, the contractor's surety took over the completion of it, and entered into a separate special contract with the bridge company for the completion of bridges. The Circuit Court of Appeals, Fourth Circuit, Massachusetts Bonding & Ins. Co. v. Concrete Steel Bridge Co., 37 Fed. (2d) 695, holds that the bridge company had a right of action for payment against the surety under the special contract. It was not limited to an action on the bond given by the surety for the original contractor.

DAMAGES AND LIABILITIES

No Damages Allowed for Delay in Making Payments

The New York Appellate Division holds, O'Rourke Engineering Const. Co. v. City of New York, 241 N. Y. S. 613, that a sewer contractor could not recover damages for the idleness of its plant caused by the city's delay in making payments when due and as the work progressed pursuant to the monthly estimates. The court distinguished other cases where the damages flowed from causes which were obviously natural consequences of the other contracting party's default. This, however, the court held, could not be claimed of a failure to make prompt payments, and cited cases holding that such damages are not within the contemplation of the parties to the contract.

Damages for Breach of Subcontract to Haul Gravel

A materialman, having secured a contract to furnish materials to a road contractor, contracted with another for the hauling of gravel at a specified rate, the hauling charges to be paid 24 hours after receipt of the money for the month's hauling from the road contractor and the payment to be contingent on such receipt. Before any work was done the materialman's contract with the road contractor was canceled. The materialman wrote the subcontractor as to this, virtually renouncing the contract for hauling. The subcontractor sued the materialman for damages for breach of contract. Holding that he was entitled to recover, the California District Court of Appeal, Morrison v. Sycamore Canyon Gravel Co., 283 Pac. 84, said that the clause in the contract authorizing the delay in the payments for hauling was no defense. Although, by agreement, the payment for services may be made conditional upon receipt of a special fund or from a designated source, in this case the provision relied on by defendant was not a condition precedent, but merely a proviso for deferred payments, and conferred no option to cancel the contract on failure of the fund.

If the contract had been conditioned upon the road contractor exercising an option to haul the material himself and he had subsequently decided to do so, that would have terminated the contract with the plaintiff. No such condition, however, existed. The road contractor fulfilled his agreement to purchase the material from the defendant, and it was subsequently hauled and delivered. The evidence indicated that the motive for repudiating the contract with the plaintiff for hauling the material was an expectation on the part of the road contractor or the defendant to procure the hauling for less than the contract price.

Contractor's Surety's Liability to Sub-Contractor

In an action by a subcontractor for highway construction against the principal contractor and his surety for an alleged balance due, the Louisiana Court of Appeals held, Dewil v. Union Indemnity Co., 120 So. 654, that the defendants could not complain that the court considered evidence showing a quantity or measure of work done in excess of that shown in a statement annexed to the petition, where they knew of the contract and the work called for by the specifications and the judgment was within the balance claimed to be done.

The surety was not bound by the books of the contractor, who defaulted, admitting indebtedness to the subcontractor, where the surety was not bound under its bond to pay the contractor's debts, but only for work, labor, material, etc., used in the construction of the work. The subcontractor was bound to establish his claim to the balance alleged to be due him. The surety would not be liable for an allowance given by the contractor to the subcontractor to keep the latter in good spirits.

Road Contractor's Liability for Lack of Barricades

Independent contractors for the construction of a road, a federal-aid project being constructed under the supervision of the state highway department, whose contract with the county contemplated the use of the road while under construction, and provided that the contractor should erect barricades, danger warnings and detour signs, were not agents of the United States or of a subdivision of the state so as to be exempt from liability if they left the road unprotected with a drop of 12 feet to a railroad cut, which was to be crossed by a bridge to be built by another contractor. In an action for the death of occupants of an automobile which went over the road, where the evidence conflicted on the question of negligence in failing to erect barricades and signs, it was held properly left to the jury. Owens v. Fowler, C. C. A., 5th Circuit, 32 Fed. (2d) 238.

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Personnel Changes

Martin H. Weyrauch has been elected vice-president of the Closson-Parkhurst Engineering Corp., 105 West 40th Street, New York.

Link-Belt Company, Philadelphia, Pa., announces the appointment of Frank W. Lovett as engineer in charge of sewage disposal equipment in the Western territory. Mr. Lovett is located at the company plant office, 300 West Pershing Road, Chicago.

Willard H. Dow has been appointed president and general manager of the Dow Chemical Company, Midland, Mich., to succeed Dr. Herbert H. Dow, deceased.

B. H. MacNeal has been appointed Southern District Manager of the Crane-Shovel-Dragline Division of Link-Belt Company, Chicago. He will have his headquarters at the Company's Birmingham, Ala., office.

The Sterling Engine Company has opened up a New York City office with William Edgar John as manager. The office is located at 900 Chrysler Building.

H. E. Bernt has been appointed district sales manager of the Boston office of the Pennsylvania-Dixie Cement Corp. and R. M. Penman is assistant.

The San-Dis Engineering Corp. has moved from 15 Park Row to 3714 Grand Central Terminal Building, N. Y.

W. W. Boone and the heirs of C. Wester announce the formation of Boone & Wester, Inc., to carry on the general contracting and levee construction work of the former firm of Boone & Wester.

The Pacific States Cast Iron Pipe Co., Provo, Utah, announce that their Denver, Colo., office is now located at 226 Continental Oil Building, Eighteenth and Glenarm Streets.

The Paradon Company, Arlington, N. J., announce the appointment of the following representatives for the sale and service of Paradon chlorinators: W. Austin Smith, 1207 Lynch Building, Jacksonville, Florida; C. Fuson, 246 Court avenue, Memphis, Tenn.; The Smiley Equipment Company, Kansas City, Missouri.

Bacon-Hibbard-Eichman, Inc., Cleveland, O., announces that Harvey W. Smith, of Canton, has joined the organization as vice-president and manager of the Canton branch, and that the corporate name will hereafter be: Hibbard-Eichman-Smith, Inc. On the same date the headquarters of the company was moved from Central Avenue to 999 Front street, N. W.

The American Hoist & Derrick Co. announces the removal of its Dayton office to Indianapolis, Ind., at 703 New City Trust Bldg. I. R. Bailey and Wm. M. Schoen, who has been stationed at Indianapolis for many years, will be at the new office. J. T. Conners, who is well known in the shovel field, will have charge of sales in the field.

C. F. Messinger, vice-president of the Chain Belt Company, of Milwaukee, has been elected general manager. H. S. Greene, formerly with the Barber-Greene Company, of Aurora, Illinois, who joined the Chain Belt Company in 1929, succeeds Mr. Messinger as general sales manager. Brinton Welser, formerly secretary, was elected director and vice-president. J. C. Merwin was re-elected as vice-president. A. R. Abelt was elected secretary of the company, and continues in charge of chain sales. W. H. Brandt, formerly assistant secretary, becomes assistant to the president.

The Speeder Machinery Corporation, Cedar Rapids, Iowa, manufacturers of speeder gasoline, electric and diesel powered shovels, cranes, and draglines, have recently made the following additions to its sales organization: R. F. Sanchez as export manager with offices at 50 Church Street, New York City; B. C. Larrabee as district sales engineer with headquarters at Seattle, Washington; Harry E. Zabel as district sales engineer with headquarters at St. Paul; W. A. Avery as district sales engineer with headquarters at Chicago; R. C. Higley as district sales engineer with headquarters at Dallas, Texas; A. D. Lane, formerly district sales engineer with headquarters at St. Paul, has been transferred to the Central Southwest territory with headquarters at Kansas City.

Following are some of the important changes that have taken place recently in the Sales Department, as announced by the Caterpillar Tractor Co: J. J. Crumbaugh, manager of New York Office, has been transferred to the export department and assigned to work abroad. Arthur C. Jenvey, who has been assistant sales manager at Peoria, has been transferred to New York as manager of the New York City office, succeeding Mr. Crumbaugh. W. H. Goodwin, who has been assistant sales manager in charge of the Denver sales division, has been transferred to Peoria as general assistant sales manager to E. R. Galvin, sales manager. A. E. Loder, general supervisor of construction and governmental sales has been transferred to the newly-formed experimental and development division, which has headquarters at San Leandro, Calif. Mr. Loder will be the eastern representative of this division. C. A. Spears, supervisor of construction and governmental sales at San Leandro, has been transferred to Peoria, succeeding Mr. Loder. L. G. Lawrence, district representative in Ohio, has been transferred to the Western division as district representative at Los Angeles. Sam M. Miller, recently associated with Caterpillar Tractor Co., has been assigned to the territory as district representative, formerly covered by Mr. Lawrence. C. D. Price, special representative of the sales department in Peoria, has been transferred to the Western division as district representative out of San Francisco. R. I. Wallingford, former district representative in the Amarillo territory, has been assigned to special work. P. R. Ferrell, has been assigned as district representative in the territory formerly covered by Mr. Wallingford. F. M. Stewart, district representative at Great Falls, Mont., has been assigned to special work. H. G. McClurg has been appointed district representative in the territory recently covered by Mr. Stewart. A. H. Snow, former district representative in the Grand Forks territory, has been transferred to the export department and will eventually be assigned to work abroad. T. V. Marks, formerly on special work, has been appointed district representative to succeed Mr. Snow. L. W. Werner, recently associated with Caterpillar Tractor Co., has been assigned to the Glendive, Mont., territory. E. I. Stouffer will be assistant sales manager in charge of the Eastern portion of the Eastern sales division.

OBITUARY

Dr. Herbert H. Dow, president of the Dow Chemical Company, Midland, Mich., died suddenly on October 15. Dr. Dow was generally recognized as one of the five foremost chemists in the country and was recently nominated for the Chemical Markets medal by Henry Ford. The honorary degree of Doctor of Engineering was conferred upon him by the Case School of Applied Science in 1924 and by the University of Michigan in 1929. The Perkin medal in chemistry for 1930 was awarded to him early this year. This is the highest award given industrial chemists and is awarded annually for the most notable work in industrial chemistry.

Louis Tribus, civil and hydraulic engineer, who was commissioner of public works of the Borough of Richmond, N. Y., from 1902 to 1913, died Nov. 9 in his sixty-sixth year. Mr. Tribus was born at Northampton, Mass. In 1885 he finished his engineering course at New York University, receiving the degrees of B. A. and C. E. After two years with Samuel R. Bullock & Co., constructors of water works systems, he returned to his alma mater as instructor and acting professor in the School of Civil Engineering, remaining until 1890.

There followed eight years of private practice as a consultant on problems of civil and hydraulic engineering and then Mr. Tribus established the firm of Tribus & Massa, consulting engineers, 15 Park Row, N. Y., of which he had been the senior member ever since.

Water Supply, Sewage Treatment and Refuse Disposal in 1930

(Continued from page 44)

Sewage for the forthcoming 7th Edition, is now under way and will probably be completed and published by the A. P. H. A. in 1932. Intensified laboratory control of sewage treatment processes during the past few years and the increasing need for simplifying tests of operating efficiency has made such revision more necessary than heretofore as respecting sewage works analysis.

No marked changes in processes or methods of sewage treatment have been advanced by accredited workers in this field during the year. Closer study is being given to the separate sludge digestion process and considerable valuable data are being collected which will aid greatly in determining the suitability of selection and detailed design of plants of this type.

It is apparent that an increasing proportion of activated sludge plants are being planned and constructed at points where area for other types of plants for complete treatment is limited, where exceptionally good effluents are required or where a high degree of treatment is paramount to questions of operating costs.

Research laboratory and plant scale experimentation is being continued at many points to determine the proper and economnical use of chlorine in its main function of disinfection or sterilization as well as in odor control, protection of masonry sewers, filter ponding relief, reduction of bio-chemical oxygen demand, Imhoff tank foaming and deodorization of gas from tanks.

Refuse Disposal

Progress in the refuse disposal field during 1930 has consisted, chiefly, in the extended small plant construction program which has been carried on.

Incineration may be said to have practically supplanted, in this country, the earlier methods of hog feeding, sanitary fill, and grease extraction or utilization, as respecting new projects as well as in replacements of old plants or methods of disposal.

It is estimated that there are nearly 300 municipal refuse incinerators in operation in the United States at present and that one-half of these plants have been constructed within the past four years.

Furnace design, especially in regard to furnace arches and to more rugged construction of linings and of stoking throats, is being constantly improved and beneficial competition has been active among incinerator manufacturers during the past year in many other features necessary to operating efficiency, such as ease of stoking, drying hearth and drying bin facilities, preheating of forced air draft at the larger plants, and provision for storing and charging proper mixtures.

In general, the basis of action for providing municipalities with refuse incinerators economical in design as to layout of plant, capacity, provision for future extension and facilities for handling refuse, is far from being satisfactory and will not be until the whole problem at each point is approached from an independent, engineering standpoint, including the setting up of a fair and adequate basis for open competitive bidding.

Among the larger plants completed in 1930 are the refuse incinerators at Winston-Salem, N. C., capacity 500 tons in 24 hours, and the plant at Cedarhurst, N. Y., with a capacity of 200 tons.

Among the projects underway are two refuse incinerators for Washington, D. C., with capacities of about 300 tons each, a plant at Erie, Pa., with a capacity of 150 tons, and a 140-ton extension of the incinerator at Stamford, Conn.

The Sanitation Commission of New York City, formed a year ago under an amendment to the charter, is planning the construction of some 19 new incinerators in the city, principally in Manhattan and the Bronx.

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Money paid for a piece of road machinery helps to keep a number of mechanics at work. Deferred purchases may mean closed plants. Buy Now!

Refuse Disposal Methods in Nearly Twelve Hundred Small Municipalities

(Continued from page 38)

ably on a dump), 6; contract collection and disposal, 7; farmers, one; individual or private collection and disposal, 8. Incinerators are now being constructed in 2 communities.

North Carolina.—Twenty-two replies. Of these, 11 report dumping and 3 burning, probably on dumps. In 8 communities there is no organized system of collection and disposal.

North Dakota.—Replies from 9 villages received. Seven of these employ dumps, and the other two either rely on the individuals or have no service.

Ohio.—Sixty-four replies. These indicate that burial is employed by 3 communities; dumping by 17; feeding to pigs by 5; burning by one; contract disposal by 13; incineration by 2; and that no provision is made in 23.

Oklahoma.—Twenty-six replies received. Garbage is sold by one community; fed to hogs in 2; disposed of by contract in one; and dumped in 10. In 12, no provision is made for collection or disposal.

Oregon.—Information received from 13 communities. One village states that it needs an incinerator but cannot now afford it; 6 employ a dump; in one garbage is fed to hogs; it is dumped into a river by one; in 5 no provision is made.

Pennsylvania.—Eighty-one returns. In 14 communities, disposal is by contract; garbage is fed to pigs in one; burned, probably on a dump, in 4; incinerated in 2; buried in 2; and disposed of on a dump by 20. No provision for collection or disposal is reported by 38. One contracts with a reduction company, and one with a disposal company.

Rhode Island.—Though returns were received from 12 communities, complete data were not furnished by any of them.

South Carolina.—Twenty replies. Only 6 of these report no provision for collection or removal of garbage. Dumping is the method in use by 10 towns, and burning on a dump by 3 others. Burial in pits is practiced by one.

South Dakota.—Replies received from 7 villages and cities. Three of these have no provision, and the other 4 employ dumps for disposal.

Tennessee.—Eighteen replies. Of these, 8 employ a dump for wastes; 6 have no provision; one feeds to pigs (through a collector); one dumps into a hole, and one into the river. One has an incinerator.

Texas.—Data received from 51 municipalities. Of these, 14 employ dumps and 6 others burn, probably on outdoor dumps; 4 have incinerators; one disposes of its waste by individual contracts; and 26 have no provision.

Utah.—Returns received from 7 municipalities. Of these, 4 report disposal by dumping and 3 state no provision is made.

Vermont.—None of the 7 places reporting has any provision for collection or disposal of garbage.

Virginia.—Of 16 communities reporting, one employs an incinerator for garbage disposal; 2 burn, probably on a dump; 5 employ a dump; one dumps into a river, and 7 make no provision for collection or disposal.

Washington.—Fourteen reports. One states that it is compulsory for property owners to care for their own garbage; one dumps in a river; one burns; one contracts for collection and removal; in 4, dumps are used; and 6 have no provision for collection or disposal.

West Virginia.—Replies were received from 12 villages. All but 2 report some method of disposal for garbage. Two

use incinerators; one burns on a dump, and the remainder have municipal dumps, excepting one place where disposal is by contract.

Wisconsin.—Of 34 communities, 9 report disposal of wastes on dumps; one by burning, probably on a dump; 4 by private contract; 2 by burial; one by fill; one by contract; and 17 make no provision for collection or disposal.

Wyoming.—Of six villages reporting, 5 dispose of their wastes by dumping and one has an incinerator.

Municipal Water Softening vs. Domestic

(Continued from page 34)

same water softened to an average hardness of about 80 p.p.m. Ivory soap in bar and flake form was used, the former costing 21 cents a pound, the latter 31 cents, for household purposes—laundering, dish washing, cleaning, washbowl and tub bathing—the average weight of washings being 29 pounds, done in a vacuum type electric washer; and the amount of soap and of water used each week was measured carefully.

This family used 281 gallons of water a week for ordinary household cleaning divided as follows: Laundry 15 gallons; dishwashing 73 gallons; cleaning 4 gallons; bathing 136 gallons. Approximately 11.46 pounds of soap were used per week with unsoftened water, or a total of 596 pounds per year; and approximately 3.7 pounds of soap were used per week with Columbus city softened water, or a total of 192.5 pounds per year.

Softened water therefore saved this family 403.5 pounds of soap per year, which, valued at 20 cents per pound, represents a saving of $80.70 per year; and figured at 12 cents a pound (the price of cheaper laundry soaps) represents a saving of $48.42. This consumer could afford to pay five or six times as much for softened water as for unsoftened water.

The investigation also disclosed that one-half again as much time was needed to launder clothes in the unsoftened water as with the softened, and the cleanliness of clothes washed in the unsoftened water was not entirely satisfactory; several very soiled pieces had to be rewashed and all of the clothes had to be rerinsed, and the general appearance of the clothes was poor.

These figures may be high for the average family but they are, it is believed, representative for a family of pride living in moderate circumstances.

Softened water tastes as well and is as healthful as hard.

There are two well known processes for softening water—the lime or lime-soda ash process, and the zeolite process. In the former, lime or lime and soda ash are stirred into the water and precipitate the calcium and magnesium compounds, which are almost entirely removed by settling, and the water is then carbonated with carbonic acid gas to stabilize it. It then is usually filtered through sand.

In the zeolite process the water is passed through a zeolite sand composed of sodium, aluminum and silica. When hard water comes in contact with it, the calcium and magnesium in the water exchange places with the sodium of the zeolite. The zeolite looses its sodium, the water its calcium and magnesium, and is softened. When the zeolite has traded all of its sodium for calcium and magnesium it will soften no more water until it is regenerated by bringing salt water into contact with it. The salt water drives out the calcium and magnesium, and the zeolite absorbs a new supply of sodium from the salt, again rendering it active.

Both processes have their advantages. These depend largely on the character of the water treated, and the purpose for which it is to be used. Generally speaking, it is more economical to remove carbonate hardness with lime, and sulfate hardness with zeolites.

When lime is added in sufficient quantity, under scientific supervision, to produce caustic alkalinity, it kills intestinal and pathogenic bacteria, rendering the fluid bacterially safe.

Carbonation of lime-softened water, and excess lime treatment followed by carbonation, are perhaps the greatest advances that have been made in lime-soda water softening since the process was first conceived. Incrustation in distributing systems has been eliminated by carbonation, and the limited results that could be obtained in reduction in hardness have been largely overcome by excess lime, followed by carbonation.

The original zeolites were of comparatively high capacity but relatively low in rate of activity; they were slow in softening and long periods of time were required for regeneration. They were also inefficient in salt consumption, using two to three times the amount of salt required with the modern rapid zeolites.

Lime treatment, followed by sedimentation and carbonation, then by zeolite treatment, is now a practical method of softening.

Reports of Sewage Treatment Plants

(Continued from page 32)

Aerator in Settling Chamber; (6) Filter Effluent; (7) Fresh Sludge; (8) Gas; (9) Activated Sludge Plant effluent. Nos. 1 and 2 provide for recording the sewage flow in m. g. d.; and figures of Nos. 1, 2 and 3 are given also as averages per m. g. and per 1,000 people attached.

The items for No. 1 are: Detention period in sedimentation tanks; Pounds of sludge, of screenings, of grit, and of skimmings, stating percent moisture; Clear opening between bars of screen; Velocity through screens, in second-feet; Percent of settleable solids in influent and effluent, by Imhoff cone test.

No. 2: Filter rate per acre-foot; Frequency of application of sewage; Retention period, in hours, in final settlers; Gallons of sludge removed from final settlers; Number of nozzles cleaned; Cubic feet of air per gallon (in case of aeration).

No. 3: Aeration period (hours); Cu. ft. of air per gallon of sewage flow and per square foot of water surface per hour; Weight of solids in mixed liquor; Quantity of sludge returned (gallons); Sedimentation rate-hours detention, and gallons per square foot per day.

No. 4: Suspended solids; B. O. D.; Total nitrogen· Nitrogen as free ammonia; Total solids; Volatile solids; Temperature; Alkalinity; Chlorine. (These results and those in forms Nos. 5, 6, 7 and 9 to be expressed in parts per million.)

No. 5: Suspended solids; B. O. D.

No. 6: Suspended solids; B. O. D.; Nitrates and nitrites; Total organic nitrogen; Nitrogen as free ammonia; Total solids; Volatile solids; Oxygen dissolved; Temperature; Alkalinity; Chlorine.

No. 7: Suspended solids; pH; Ash; Total nitrogen; Temperature; Fats; Specific gravity.

No. 8: Quantity (cubic feet); B. t. u. per M cu. ft.; CO_2 in per cent of total; Quantity of water heated (in pounds) and temperature increase: Methane (per cent).

No. 9: Suspended solids; B. O. D.; Dissolved oxygen; Nitrates and nitrites; Total nitrogen; Nitrogen as free ammonia; Total solids; Volatile solids; Temperature; Alkalinity; chlorine.

The column headings of the form for small plants is shown in tabular form on page 32.

The committee consisted of A. P. Learned, chairman; Robert Cramer, G. B. Gascoigne, John L. Mason and John C. Shaw.

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Present Trends in City Paving

(Continued from page 22)

The use of paving brick in cities has remained steady for the last several years and this type has maintained its popularity in sections of the country to which it can be transported economically. According to the National Paving Brick Manufacturers Association, shipments of brick during 1930 for city and highway paving have shown an increase of about 20% over the same period of 1929.

Stone block types are used primarily in warehouse districts where the traffic is very heavy and slow moving.

Concrete Bases and Pavements

The vast majority of pavements laid in cities have a concrete base while a small percentage is of the finished concrete type. Trends in paving practice vary from city to city and from one section of the country to another, however, and statements made must be general as based on the observed practice of a representative group of cities in all localities. The testing and selection of aggregates is yearly more rigid, and at the same time, nearer to standardization. Most cities now have a testing department or else have their materials analyzed and tested by commercial laboratories. The old arbitrary method of designing proportions, such as 1-2-4 (field volume), is fast giving way to a design which takes into account the actual grading and voids-volume of the aggregates. Stimulated by current highway practice, several cities are requiring that all aggregates be measured by weight rather than volume. The significance of the water content of concrete is being more widely appreciated and the trend is toward the use of the water-cement ratio, or at least a definite maximum water content per bag of cement.

Concrete Bases—No definite general recent changes are observed in the proportions of cement to aggregate in bases. If any trend can be observed, it seems to be slightly toward the use of more cement per cubic yard. The 1-3-6 mix generally used many years ago in bases has in many cases given over to designed mixes approximating a 1-3-5 or even a 1-2½-5. Concrete bases are somewhat thicker now than formerly and although varying from 4 to 10 inches, seem to average almost 7 inches rather than 6 inches as observed a few years ago. Thickness is being varied more than ever with the volume and weight of traffic, present and anticipated.

Finished Concrete Pavements—Increased attention is being given to the quality of aggregates, design of the mixture, mixing time and water content. More competent inspectors are being employed and more thorough inspection is required annually. Politically appointed, untrained inspectors are gradually being replaced with competent men trained in engineering work.

The proportions of cement to aggregates in finished concrete pavement show a slight trend upward. More significant than this, even, is the fact that higher strength and better concrete is being obtained while using the same amount of cement per cubic yard of concrete. This is due to designed mixes, proper inspection, minimum water content and adequate curing. The thicknesses of concrete streets appear to have increased slightly. Although varying from 5 to 10 inches, the most-used thickness in all sections appears to be about 8 inches; and it is considered that the thicker types are being more often used than formerly. City engineers have in general accepted the formula for concrete pavement thickness in which depth of slab is based on the maximum wheel load and modulus of rupture of the concrete. In this connection it has been determined by test that stresses in slabs are local and do not extend very far from point of application of the wheel load. Therefore, if the load is carried on enough wheels the stress may be maintained at a low figure. Heavy wheel loads on a 6-wheel truck in which the axles are placed as close together as three feet will not produce any more stress in the pavement than that produced by the same wheel load on a 4-wheel truck. This significant fact has led to the more widespread use of multiple-wheel vehicles, trailers and tractor trucks, and has permitted increased activity in motor transportation. The fact that pneumatic tires create much lower impact stresses in the pavement and less shock to vehicles themselves, has led to the general adoption of pneumatic tires rather than solid type tires on trucks.

In narrow pavements, especially without curbs, the thickened-edge highway design is being more extensively used, the thickened section being usually about 40% more than the center thickness and extending from 2 to 4 feet from the edge.

Reinforcing—A well-defined trend is observed in the extended use of reinforcing in city pavements, wherein the reinforcing is distributed throughout the entire paved area. This is especially true of finished concrete pavements. The use of reinforcing is firmly entrenched in many localities and is becoming more favored each year. The trend in reinforcing favors small members, closely spaced, such as mesh, as compared to larger members, such as bars. Although not so strongly developed, there appears to exist a trend toward the increased use of mesh reinforcing in concrete bases. City engineers are more than ever interested in eliminating, controlling, and confining to small dimensions the cracking which occurs in concrete in pavements and bases, both to extend the life of the pavement and decrease maintenance costs, and to improve the appearance of the streets, and many departments have followed the findings of completed research which show such reinforcing beneficial for these purposes. Improved methods of installation have been developed so that the use of this steel does not delay nor seriously interfere with construction.

Joints—Another obvious trend is that of the extended use of joints in concrete pavements, especially of longitudinal joints, either of the metal plate or weakened plane type. Most cities use a longitudinal joint of one type or another in the center of concrete pavements 30 feet or more wide, or else on 10 or 15-foot intervals across the pavement. The "dummy" type joint, formed after the concrete has been deposited and struck off, has been developed and used widely for this purpose.

The use of transverse contraction joints has grown recently, especially in cities on the west coast. These joints are of the plate or weakened plane type and are usually used in connection with transverse expansion joints.

Almost all cities on which information is available use transverse expansion joints in concrete pavements. The spacing varies from 20 to 60 feet, the average being about 38 feet but 50 feet being most generally used. Several cities place transverse joints at from 60 to 100 feet, but in such cases usually place transverse contraction joints between these, so that slabs are divided into lengths of from 15 to 30 feet. The widths of expansion joints are about ½ inch for 50

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Mixing mineral aggregate and Cut Back Asphalt on the roadway.

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feet spacing or less and ¾ to 1 inch above 50 feet. The premolded type seems to be most favored. The use of a sponge rubber joint has been extensive on the west coast but appears to have been used only experimentally elsewhere. Through the proper use of transverse and longitudinal joints, control of large cracks is effectively accomplished as to location, and combined with light-weight reinforcing, cracking may usually be eliminated altogether. This fact is being appreciated more each year by city engineers, with a corresponding increase in the use of such designs.

Curing—The trends in types of curing mediums for concretes are not well established. It is safe to say that curing is more generally carried out now than formerly and that curing requirements are being better enforced. Although it is conceded the best medium, wet earth curing is often impractical in cities. Sprinkling, wet burlap or ponding is more extensively used, and the development of asphaltic curing mediums has found favor in many localities. Although there is still much room for improvement in curing in many cities, the gains already made are gratifying.

Ready Mixed Concrete—A decided trend is observed toward the development and use of ready-mixed concrete. About 60% of fifty leading cities throughout the country, as canvassed by the American Road Builders' Association, permit the use of ready-mixed concrete in bases or pavements. This is a recent development and is fast gaining favor with city engineers. This trend is more marked in city paving than on State highways, as might be expected.

Testing Concrete—The practice of taking cores from completed pavements has grown to a marked extent. These cores are tested for thickness and strength and sometimes for grading analysis. Such a policy serves as an actual as well as a psychological check on the work of the inspector, the construction forces and those responsible for curing. There is also a marked increase in the number of cities using field cylinders and beams to determine the time at which the concrete in the street has gained sufficient strength for opening to traffic. As between cylinders and beams, the use of the latter appears the most accurate for this purpose and is increasing.

Brick Paving

For many years the general trend in brick paving was toward the use of thinner brick and varied from the former usual 4 inches to as low as 2 inches. At present, however, this factor is somewhat stabilized, and 3-inch brick is the general thickness, with considerable 2½-inch being used in the western and southwestern cities.

Brick on which lugs are formed to permit a positive admission of filler seems to be more favored each year, especially in eastern cities, although cities in the west generally retain the lugless or plain type of brick.

The trend for several years has been toward the use of a bituminous filler and this is extensively employed at present. A study of this subject is being conducted by a committee of the Highway Research Board and it is hoped that further improvements in bituminous fillers will be made.

Sand is the customary material used for cushion under brick pavements, while granulated slag is preferred where available. A somewhat new development is the use of a mastic cushion composed of sand and bituminous binder. The value of this material, although used to a limited extent, has shown up well; further development and more widespread use is anticipated. The thickness of all types of cushion varies from ½ to 1½ inches, with the 1 inch thickness being most generally used.

Stone Block

Stone block is largely used in warehouse districts, along wharves, in street car tracks and on steep grades. The general use of this type paving, due possibly to its high cost and the fact that block surfaces are seldom smooth for high-speed auto traffic, does not seem to have increased.

Asphaltic Wearing Surfaces

In the construction of high-type asphaltic wearing surfaces, the use of mechanical finishers has been a recent successful development. The use of such equipment by cities has shown an increase during the past few years for both asphaltic and concrete pavements.

Cold-laid asphaltic mixes have been more generally developed and extended in city use for the past few years. Many of these types are proprietary and have found much general favor as high-type wearing surfaces. Through recently developed tests, stability of asphaltic mixtures may now be predetermined accurately and this has led to improved construction in these types.

In asphaltic surfaces the use of spreader boxes for expediting the placing of material and for obtaining proper thickness with a minimum amount of raking, has increased from year to year. Requirements for a smooth surface are more and more stringent. The contour of the foundation is a contributing cause of roughness, and initial surface unevenness is now considered productive of later waving. The narrow limits of permissible variation of contour require constant use of the straight-edge, and most cities use some type of mechanical instrument which indicates the deviation from a straight-edge to determine the location of high and low spots.

Low Cost Types

Although high-type pavements are preferred where traffic justifies and funds permit, the use of low-cost highway paving types is increasing in city construction. In smaller towns, undeveloped areas of larger cities, and on light-traffic streets, these types are being employed extensively. "Low-cost types" are generally considered to include those which cost less than a penetration bituminous macadam. Bituminous types show the greatest increase in use, and include surface treatments, mixed-in-place and retread bituminous macadams. Although these types have been well developed for rural paving, city engineers are having to give much attention to their adaptation to city street construction. This is a promising field and further development should be made by city engineers to take advantage of the benefits of the use of such types.

Costs

Although difficult to evaluate accurately, due to various types and conditions, the general trend of paving costs in cities is downward. This decline has covered several years and 1930 prices are possibly lower in general than those observed for many years. This trend may easily be explained from an economic standpoint. Contributing causes are, a decided decrease in building construction, the effect of the business depression causing smaller city paving programs, increased competition among contractors, cheaper materials, lower labor costs due to unemployment, and the more economical methods of construction through the vast improvements made in equipment used for this work.

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Operating Results at the Worcester Sewage Treatment Plant

(Continued from page 28)

than in 1928. Removal of organic matter contained in the Imhoff tank effluent was 32.4 per cent as shown by organic nitrogen and 80.2 per cent according to biochemical oxygen demand. The latter figure is better than 79.3 of last year. Nitrification which was about twice as great in 1928 as in 1927 has been further improved during 1929. This is especially true of filter A effluent. The dissolved oxygen content of the filter effluents is greater than in 1928; again filter A effluent shows a marked improvement. Perfectly stable filter effluents have been obtained since March 13, five weeks earlier than in 1928."

According to the Gooch method, the suspended solids content of the final effluent of the secondary settling tanks was 84 p.p.m. (and according to the residue on evaporation 68 p.p.m.) as compared to 317 for the raw sewage. The B. O. D. was reduced from 178.5 in the raw sewage to 17.8 in the final effluent.

The cost of maintenance and operation of the sewage treatment plant, based only on pay roll charges at the plant, was approximately $5.21 per million gallons of sewage treated by the plant. Including all materials and supplies, teaming and department transfers of labor, the department records show a total net expenditure of $55,607.54, representing a cost of $7.45 per million gallons of sewage treated by the plant. All sewage received at the plant passed through the grit chambers and was screened before treatment or by-passed to the final effluent channel.

The plant cost approximately $3,870,000, ten per cent of which (for interest and depreciation) would give about $51 per million gallons treated.

The cost of sewage treatment is summarized as follows:

	Total	Per million gallons
Screen	$2,153.26	$0.29
Grit Chamber	752.88	0.10
Imhoff Tanks	12,598.29	1.69
Trickling Filters	7,572.57	1.02
Secondary Tanks	8,890.91	1.19
Sludge Disposal	15,032.54	2.01
Laboratory	8,607.09	1.15
Total	$55,607.54	$7.45

Recent Developments in Chlorination

(Continued from page 23)

the total amount of chlorine applied, is the controlling factor in measuring the efficiency of sterilization. If the distribution of chlorine in a body being treated is inadequate, over-chlorination of some portions of the body results. The excess chlorine reacts chemically with the humus matter, forming permanent chlorine or 'separable chlorine compounds,' which have little disinfectant action. Therefore, it is an economical practice to adjust the distribution of chlorine for maximum efficiency."

Johnson made a careful study of the subject of super-chlorination, using for his work .2 to .3% aqueous solutions and dry gas with a sewage that had a chlorine demand of 9 p.p.m. He plotted his results on a curve which shows that there is very little difference between .2% and .3% solutions but that sewage will take up more chlorine as a dry gas. He noted that no two sewages gave the same super-reaction and that greater efficiency with chlorine could be obtained with some sewages than with others.

Johnson emphasizes the importance of a thorough distribution of the chlorine in the body being treated. This is a point that appears to a large degree to have been overlooked. Bunau-Varilla shows that, by agitation, the efficiency of disinfection is markedly increased, saying, in part: "Agitation, that seems at first to be of secondary importance, seems to possess an utmost value." E. Techoueyres states: "Bactericidal action is found to be better if the water is agitated during and for some time after the addition of chlorine."

It is only logical to assume that, to bring about a chemical reaction between a gas such as chlorine and a liquid such as water, or water plus sewage, the more they are agitated the more intimate the mix and the more efficient the chemical action. Race likewise calls attention to this fact. There should be no question of the advisability of a thorough mixing.

In applying chlorine to water or sewage, careful provision should be made to bring the chlorine and water into intimate contact to mix thoroughly. The impulse diffuser of the Paradon Company uses a small jet of water to drive the chlorine horizontally through the body of water being treated, the water jet crossing the path of the gas as it emerges into the body of liquid that is to be treated. The effect may be compared to the action of a liquid atomizer, in which a jet of air playing across a liquid outlet divides the solid stream of liquid into small particles.

I have mentioned the possibility of delayed or deferred action to prolong the antisepticizing action of chlorine and prevent it from using up its bactericidal action by acting as nascent oxygen and oxidizing organic material other than micro-organisms. Ammonia has come to the fore recently; though I do not understand why we waited ten years before adopting the ideas put out by Race in his experiments on chloramines at Ottawa. R. N. Perkins in 1930 stated that for ten years he had been using ammonia with chlorine for swimming pool work to maintain chlorine residual in an open-air pool exposed to sunlight at a temperature of 80° F.

The formation of chloramines in sewage by the action of chlorine on ammoniacal compounds may account for increased and prolonged bactericidal action of chlorine for sewage disinfection. Dr. J. F. T. Berliner of the research department of the DuPont Ammonia Company, in his article "Ammonia-Chlorine Treatment of Sewage," read September 6, 1930, at the Syracuse meeting of the New York State Sewage Works Association, criticized the old method of Wanklyn which dates back to 1885—free and albuminoid ammonia determination—which in forty-five years we have not changed nor improved upon. Berliner stated that: "There are a number of basic materials in sewage that yield to direct and steam distillation and which would, under ordinary analysis, be reported as free ammonia—indoles, skatole, peptone, decomposition products, carbonates, volatile amines, hydrazines, etc." For those interested, a study of the use of ammonia with chlorine for sewage treatment in attempts at increased efficiency may prove of value.

A study of available literature indicates that chlorine as a disinfectant appears to be more efficient in alkaline solution. One process makes use of a tower

IF YOUR CITY

Your Home—Were Destroyed by Fire

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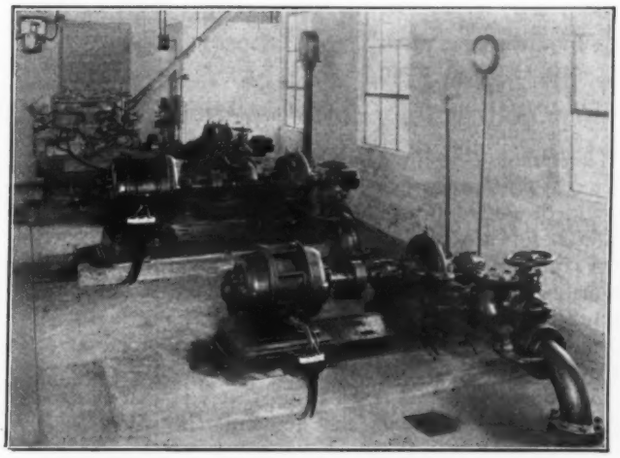
Sterling High Duty Internal Combustion Engines

12 to 565 B.H.P.
Gas or gasoline



Chesne, S. C., guards its water supply with a 500 G.P.M. 200' head centrifugal pump made by Pennsylvania Pump and Compressor Co. direct connected to a 1400 R.P.M. 4 cyl. 100 H.P. Sterling.

Exhibiting at the Power Show, New York, December 1-6th.

STERLING ENGINE COMPANY, Dept. C-5, Buffalo, N. Y.

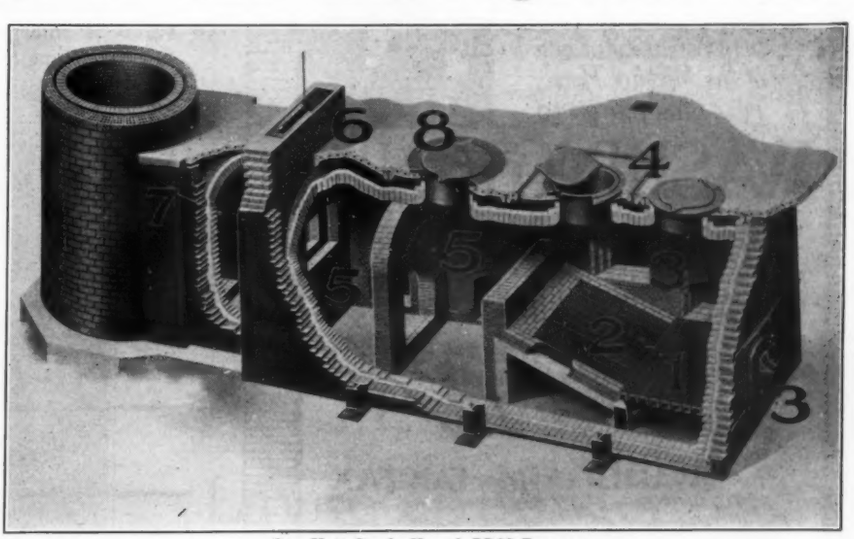
The "Pittsburgh-Des Moines" Incinerator Utilizes ALL of the Garbage as Fuel

It saves the equivalent of 120 pounds of coal in every 2000 pounds of garbage burned.

One pound of ordinary mixed garbage and refuse, *after drying* has a fuel value equal to approximately 3/10 of a pound of coal. To obtain maximum operating efficiency and economy an incinerator should, therefore, be so designed that *ALL* of the dried garbage can be utilized as fuel.

About 20 percent of the dried garbage in many other incinerators becomes lodged in or rolls to a "dead" portion of the furnace, that is, between the main mass of wet refuse and the furnace outlet flue. This "dead cell" material can never serve efficiently as fuel to dry another incoming wet charge of rubbish. Why waste this usable fuel equivalent — equal to 120 pounds of coal in every 2,000 pounds of garbage charged into the furnace? There are no "dead cells" in the PDM furnace.

State your population and write today for your copy of the new PDM Incinerator Catalog.



One Unit Single Hearth PDM Furnace.

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2.—*Sloping (Drying) Hearth.*
3.—*Stoking Doors.*
4.—*Charging Doors.*
5.—*Combustion Chambers.*
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Pittsburgh-Des Moines Steel Company

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containing limestone through which the aqueous solution of chlorine is passed, the purpose being the neutralization of the hydrochloric acid formed. It might prove advisable in certain cases to add to the water sodium hydroxide or carbonate. That this hydrochloric acid may be considerable is shown by J. W. Ellms in "Sewage Disinfection at Cleveland":

	P.p.m. Cl.	Decrease in Alkalinity.
Easterly sewage plant	8	20
Westerly sewage plant	8.7	17

A ratio of reduction of 2 p.p.m. alkalinity for each part chlorine.

If ammonia is used and chloramines are to be formed, the water must be alkaline. Ammonia should be added first and thoroughly mixed with the water before the chlorine is added.

A further study of the use of chlorine as hypochlorite of sodium should be made; the study should include the possible use of chloramines. Berliner informs me he has made .3% solutions that are stable at normal temperatures in the sunlight.

At Cleveland, when treating filtered water with ammonia and chlorine, the ammonia is added but forty seconds before the chlorine. It is thoroughly mixed with the water, however, as the water falls down a cascade before the chlorine is applied.

Several reports are to the effect that ammonia-chlorine treatment is very efficient in reducing algae.

When dealing with clear or filtered waters, to maintain a chlorine residual of 0.1 p.p.m. with chlorine alone, there should be introduced 0.3 to 0.7 p.p.m. chlorine; but with the ammonia-chlorine process, for a like residual, use 0.1 to 0.2 part of ammonia with 0.15 to 0.25 part chlorine. Records of plants using the combined ammonia-chlorine treatment show a ratio of about 3 parts chlorine to 2 parts ammonia. In almost every instance there is a reduction in the amount of chlorine required.

In connection with the use of ammonia with chlorine, a word of caution is advisable. Ammonia has been used to eliminate phenol taste, tastes due to overchlorination and also those due to algae and other vegetable growths. In using ammonia, operators have found it possible to reduce the amount of chlorine. An excess of ammonia can do no harm, however, so there is some tendency to use crude, home-made devices for controlling the amount of ammonia. These devices are wasteful of ammonia, especially in small plants. While the small plant operates 24 hours per day, there is no supervision at night and with a makeshift apparatus it is quite conceivable that no ammonia would be applied at times when supervision is not available. If the amount of chlorine is cut down, it means that during these periods there will be insufficient chlorine used to properly sterilize the water. This may result in an epidemic. It is absolutely imperative, if ammonia is going to be used with chlorine, that the amounts of ammonia be controlled just as carefully as you now control chlorine and that properly designed machines be used for this purpose.

Georg Ornstein in Germany has published some interesting results with chlorine copper for algae. He passes a portion of the discharge from his chlorinator tower (using the absorption tower method) through a container holding copper chips. The chlorine solution dissolves a certain amount of copper as chloride. He reports the following results: "The effectiveness of chlorine as an algaecide can be greatly increased by traces of copper. Killing of algae was accomplished with 2.5 p.p.m. Cl and .18 Cu, where doses of 20 p.p.m. Cl or doses of 100 p.p.m. $CuSO_4$ failed."

Among the many uses of chlorine is that of sterilizing new mains. For this purpose a portable chlorinator should be used. Portable chlorinators are of value as emergency machines or as spare units and for experimental work, with many possible applications such as prechlorination and in a chloro-boat for algae control.

Further studies should be made to determine not how much chlorine should be used, but how little can be used to get the desired results, which are: A safe water and a minimum of operating costs. In this work, proper and thorough mixing are of most importance.

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In the Heart of the City
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Double with bath $5.00 to $8.00

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COMPLETE in three handy volumes, these books cover adequately but briefly the essential data regarding *Water Supply, Sewerage, Water Purification, Sewage Treatment and Municipal Refuse.* Attractively bound in blue, semi-flexible covers. Sent postpaid for $5.00.

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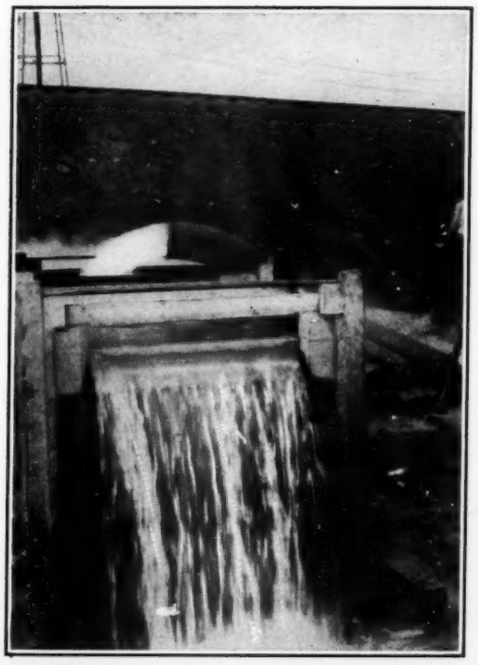
W. A. Riddell Company, Bucyrus, Ohio

Power and Drawn Graders—Wheeled Scoops—Rear-Type Crawlers for Tractors



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the best asset!

Prospective homeseekers, investors and new industries always investigate your water supply. They demand plenty of good water at reasonable cost.

Hundreds of towns have prepared for this investigation by installing Layne Well Water Systems. They contracted with a concern which did everything—no divided responsibility—and on the basis of "water or no pay."

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Torreon, Mexico

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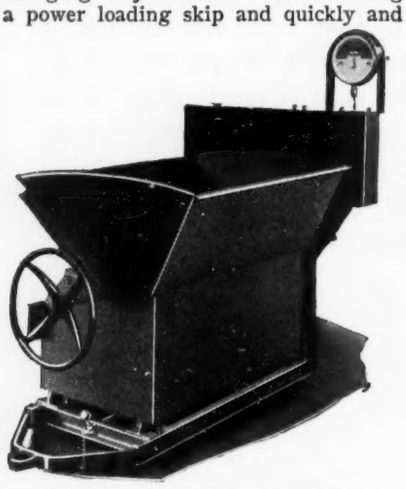
Money Saving Equipment for t

A Weight Batcher for Mixers

A convenient device suitable for charging any concrete mixer having a power loading skip and quickly and accurately measuring pre-determined amounts of concrete aggregates by weight has recently been developed by The Knickerbocker Company, Jackson, Michigan. It is known as the "Tilt-Weigh" Batcher.



Knickerbocker Tilt-Weight Batcher.

Operating entirely independent of the mixer, it can be used to charge any type of mixer equipped with a power loading skip. It is placed close to the end of the mixer skip and may be charged by the most convenient method conditions permit. If stock piles are adjacent, materials may be shoveled in. If stock piles are not close enough for this method, materials may be wheeled and dumped into the batcher hopper from a low platform. Certain unusual layouts would permit spouting of materials, but ordinarily the wheeling method is most practical, especially on bridge construction.

"Tilt-Weigh" Batcher is built in two sizes—2-bag and 3-bag 1-2½-4 mix. The hopper of the 2-bag size will hold 13 cu. ft.—the 3-bag, 19½ cu. ft.

—CONSTRUCTION COSTS ARE LOW—
BUILD NOW—

New Bucyrus 52-B Diesel

Recently introduced by Bucyrus-Erie Company is the new 52-B Diesel shovel, dragline, clamshell, crane, which they claim to be "the fastest 2¼-yard Diesel ever built." The new extra long and extra wide caterpillar type mountings are provided instead of regular mountings when low ground-bearing pressure is required. The power plant is an Atlas-Bucyrus-Erie improved, four cycle, six cylinder, solid injection, full Diesel giving great fuel economy with the Diesel's unique characteristics of increasing lugging power under a load. The machine is built for shipment on a flat car without removing the revolving frame and cab from the base.

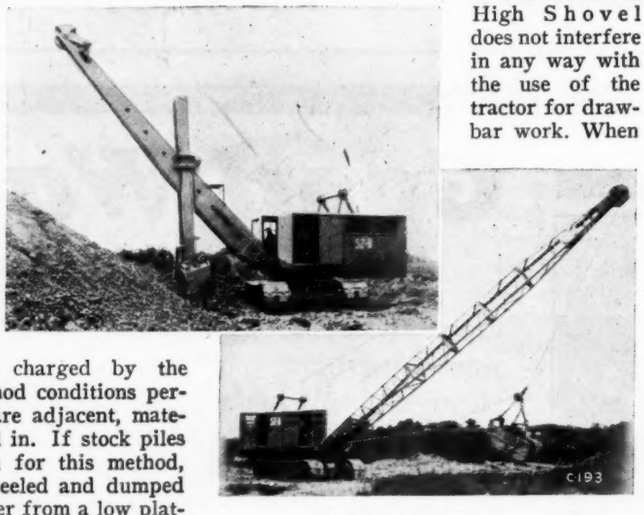
For further particulars regarding this machine write Bucyrus-Erie Company, South Milwaukee, Wisconsin, or your nearest Bucyrus-Erie dealer.

—ROADS—NOW IS THE TIME TO BUILD THEM—

New Trackson High Shovel

The new Trackson High Shovel is mounted on the Model 20 McCormick-Deering tractor, either with Trackson Crawlers or with wheels. It digs, moves, and loads materials at high speed in one continuous operation and with only one man. Although it has a high dumping clearance for loading big trucks, the machine also has all the advantages of a low-lift shovel for digging, a feature in which it is decidedly ahead of other equipment of its kind.

The Trackson High Shovel does not interfere in any way with the use of the tractor for drawbar work. When the day's program includes hauling trailers, dump wagons, etc., pulling scrapers, graders, or other road machines, or snatching a truck from the mud, the shovel may merely be locked in a partly raised position and the tractor moved right along, as easily as it would without the shovel mounting.



The New Bucyrus Diesel.

—GOOD ROADS WERE NEVER CHEAPER
BUILD NOW—

Electric Pier Hole Pump

Domestic Engine & Pump Co., Shippensburg, Pa., manufacture an electric pier hole pump with 2½-inch suction and discharge, which is designed especially for deep holes, caissons, etc., where space is restricted and where men must work close to the pump. It is just as good, however, for any kind of pumping, deep or shallow, within its range of capacity and pressure, where suitable electric current is available.

Electric Pier Hole Pump.

Trackson High Shovel.

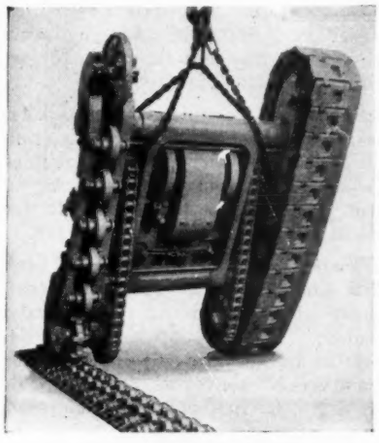
...or the Contractor and Engineer

All parts exposed to wear when handling water containing abrasive materials are made to be easily and cheaply replaced, and the pump will run in any position, vertically or on an angle, so long as the motor is kept out of water.

—ROADS—BUILD THEM AND PROSPER

Bucyrus-Erie New Caterpillar Type Mounting

Bucyrus-Erie Company of South Milwaukee announce that the E-2 Diesel dragline is now regularly equipped with



Bucyrus New Mounting.

a new style, improved, caterpillar-type mounting. The standard mounting has 27-inch treads an overall width of 10′ 6″, a length of 13′ 8½″ and a bearing area of 51.9 square feet. There is also a long truck with 27-inch treads with a bearing area of 57.9 square feet. Two styles of wide treads are also offered. The standard length with wide treads has a width of 11′ 8″ with an overall length of 13′ 8½″ and a bearing area of 63.3 square feet. This wide truck in the extra-long size giving a bearing area of 70.8 square feet with an overall length of 15 feet ¾ inch.

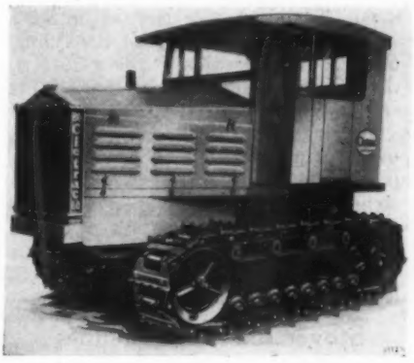
—DOES YOUR COMMUNITY NEED MORE WATER?—BUILD NOW

Hauling Bulk Cement in the West

Several interesting angles of truck operation were recently brought out in connection with the building of a dam at Ariel, Wash., by the Northwestern Electric Company. Carl Southworth, Portland, Ore., secured the trucking contract. He purchased three chain drive Sterling trucks, Model DC-27, and had mounted on them bulk cement bodies manufactured by the Earl E. Staley Company, Portland.

This is the first time that this type of body has been used in Oregon and the second time that it has been used on the Pacific Coast. The photograph shows the type of truck and body with which he moved an equivalent of 4,000 sacks of cement per day.

The bodies, which are water-tight,



A Cletrac for Winter Use.

are dumped by St. Paul hydraulic hoists. After dumping, any cement sticking in the bodies is removed by compressed air, no material being wasted.

The Clarktor Shovel.

—BUILD NOW—

New Clarktor Power Shovel

The new "Clarktor" shovel is a power scoop, designed to handle any loose material such as sand, gravel, bulk cement, clay, soft coal, etc. It is said to do the work of ten to fifteen shovel and barrow men and do it in less time. The standard bucket holds 9 cu. ft. or 1500 lbs., though larger cubic capacity buckets are furnished when material to be handled is lighter than sand. Improved hydraulic cylinders enable a driver to pick up and hold the load at any desired point. The scoop approaches the pile, takes its load and carries it, dumping where wanted. Two models of different heights are available. The "Clarktor" shovel is manufactured by the Clark Tructractor Co., Battle Creek, Michigan.

Bulk Cement Body on Sterling Truck.

—ROADS—BUILD THEM AND PROSPER

A Tractor Equipped for Winter Use

The illustration above shows an "80-60" Cletrac equipped for winter use, including a completely enclosed cab, and ice grouters on the tracks. This tractor is equipped with an electric starter which eliminates hand cranking and makes it possible for the driver to operate the tractor with ease and comfort, making it unnecessary for him to leave his protected position in the cab.

Engineering and Construction Equipment

The New Michigan Power Shovel

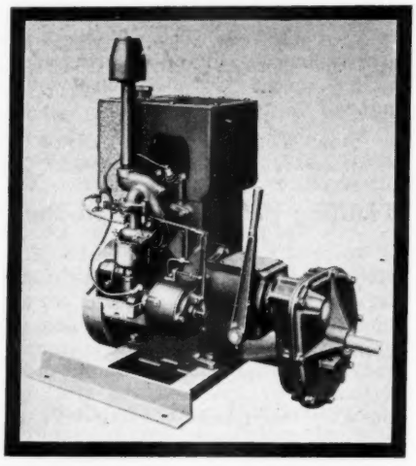
The Michigan Power Shovel Co., Benton Harbor, Mich., manufacture a power shovel, which has many advantages. The turn-table mechanism with the boom and dipper is full revolving, but the power plant, which is a 35 h.p. Allis-Chalmers, remains stationary. This arrangement increases speed and efficiency, inasmuch as the weight of the power plant is not moved with each operation. The operating width of the machine is less than 8 feet, because there is no tail swing. As a result, this machine is especially advantageous in narrow cuts and for irrigation work.

—ROADS—NOW IS THE TIME TO BUILD

Stover Industrial Engines

The line of 1½ to 8 h.p. Stover industrial engines to be exhibited at the Road Show will present new refinements of construction. They are made in either horizontal or vertical types and either hopper or radiator cooled, with or without a metallic housing. The manufacturer claims they are particularly adapted for driving cement mixers, paint spray outfits, hoists, diaphragm pumps, centrifugal pumps, irrigation pumps or other industrial need where light weight and dependability are required.

They are made in either the single or double cylinder type, and the bore and stroke are identically the same in both, so that there is a minimum investment in spare parts, since the piston, piston pins, piston rings, oil regulating rings, connecting rod bearings and connecting rods, piston pin bearings, valves, valve tappets, push rods, etc., are identically the same for both models.



Stover Industrial Engine with power takeoff.

Gramm New Series 3-Ton Motor Truck

Gramm Motors, Inc., Delphos, O., have brought out the new Series E, 3-ton truck.

This is powered by a six cylinder engine, with a bore and stroke of 3⅞" x 5". The displacement is 353.8 cu. in. The taxable horsepower is 36 and the engine develops 100 b.hp. at 2200 R.P.M. The standard chassis has a wheelbase of 160" with an optional wheelbase of 175". This vehicle carries a straight rating of 20,000 lbs. It is equipped with balloon tires.

A Fleet of Gramm Trucks on Construction Work.

New Publications for the Contractor

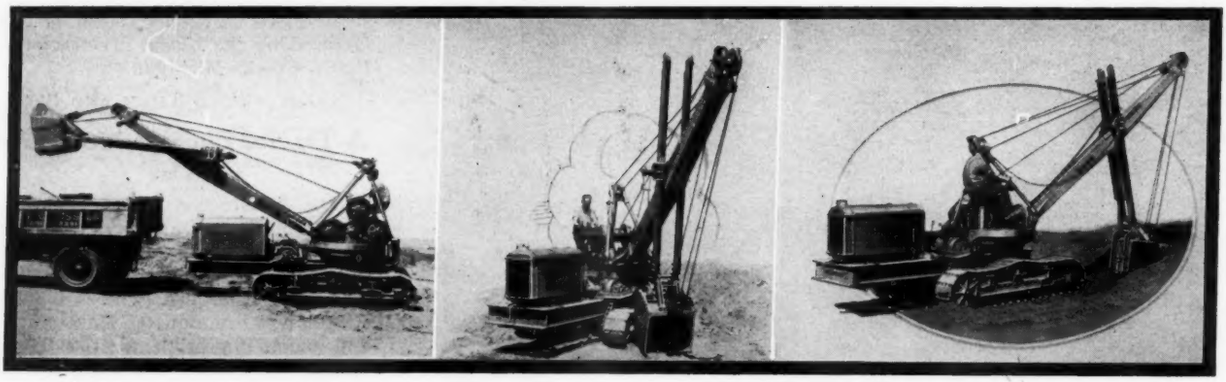
Corrugated Concrete Pipe. The McCracken Machinery Co., Sioux City, Ia., has issued a very attractive and complete 42-page catalog illustrating McCracken machinery for corrugated concrete pipe construction. A discussion of pipe making equipment is included. This covers many points of interest and value to the many who contemplate engaging in this business.

Ateco Bulldozers.—The American Tractor Equipment Co., Oakland, Calif., have just published a well-illustrated folder describing their hydraulic bulldozers which are designed for use with Caterpillar Tractors.

Dragline, Clamshell, Crane. The Dayton-Whirley Co., Dayton, O., publish a catalog describing their complete line of dragline-clamshell-crane equipment, in boom lengths up to 125 feet and in oil, steam and electric power.

Loaders and Conveyors.—The Link-Belt Co., Chicago, Ill., has issued Folder 1149, describing the "Grizzly" Loader; 1076, covering Link-Belt portable bucket loaders; 1074, "Truss Construction" conveyors, and 1073, describing Link-Belt portable loaders and conveyors.

Curing Concrete.—"A report on the current practice of using calcium chloride for curing concrete in pavements, building construction, bridges, culverts and concrete products," an 8 page pamphlet which should be of particular interest to architects, engineers, contractors, is offered by The Columbia Products Company of Barberton, Ohio. Ask for Bulletin No. 20-750.



The power plant does not revolve on the new Michigan Shovel.

there must be a reason . . .

why 25 State Highway Departments use

"GOOD ROADS" SNOW PLOWS for trucks . . .

why nine of these Highway Departments placed orders totalling 325 "Good Roads" Plows within a five weeks period this fall . . .

why they go by the hundreds to City, Town and County departments, Villages, Industrials, Trucking and Bus companies, Public Utilities, Parks, Airports, Clubs, Colleges and Schools, Farms and Estates, Cemeteries and many other private and public owners. . . .

Snow Plow Headquarters

Builders of Reversible Blade and "V" Type Snow Plows for quick attachment to any standard make Motor Truck or Bus from one ton to the heaviest built.

"There's a 'Good Roads' Plow to meet any snow removal condition."

The Good Roads Machinery Company, Inc.

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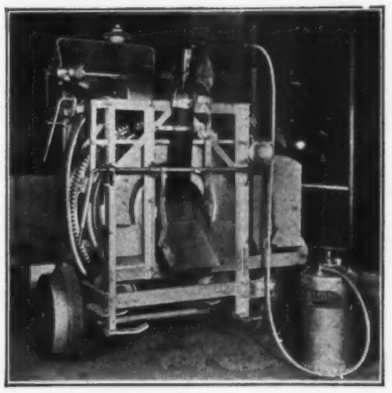
TRADE MARK

CONCRETE HEATERS

Designed to operate with all sizes and makes of concrete mixers either tilting or non-tilting. All Mohawk Torches have the exclusive patented removable coil and non-clogging vaporizing tip feature.

Write for Catalogue



HAND TORCHES WATER HEATERS SALAMANDERS

MOHAWK ASPHALT HEATER CO.

SCHENECTADY NEW YORK

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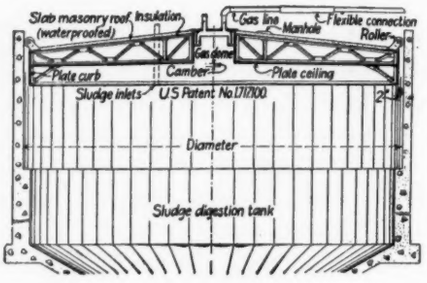
DOWNES Floating Covers

for

Separate Sludge Digestion Tanks



PROVIDE for variation in sludge content which flexibility does not exist under fixed types of concrete roofs.

They reduce initial and daily operating costs as well.

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for

Water Sterilization and Sewage Disposal

EBG

Liquid Chlorine

A valuable illustrated booklet, "Liquid Chlorine in Sanitation" will be sent free upon request.

Your water and sewage deserve the best treatment.

Electro Bleaching Gas Co.

PIONEER MANUFACTURERS of LIQUID CHLORINE

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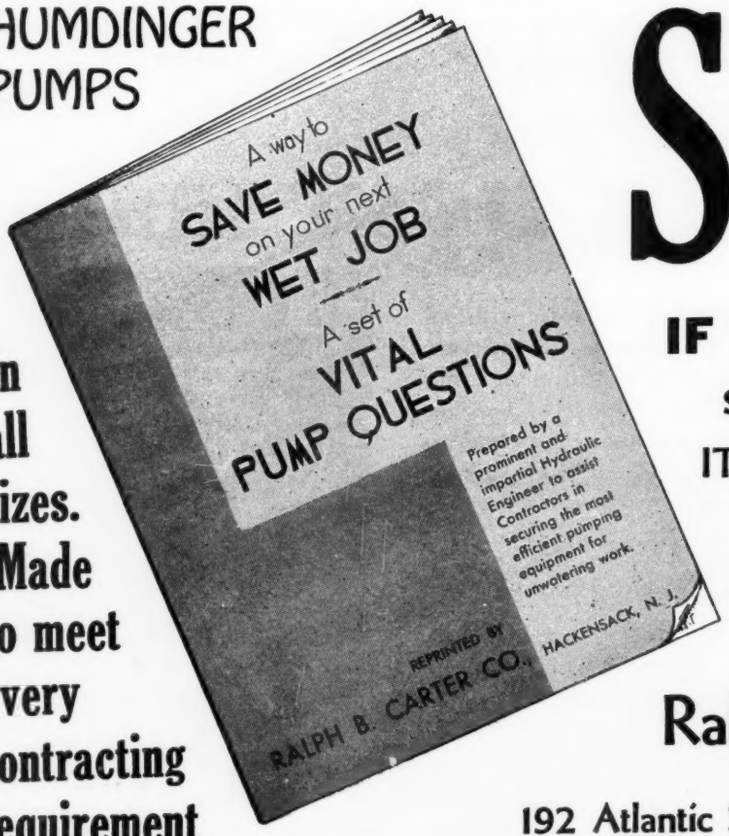
in all sizes. Made to meet every contracting requirement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SAVE MONEY
on your next
WET JOB
A set of
VITAL
PUMP QUESTIONS
Prepared by a prominent and impartial Hydraulic Engineer to assist Contractors in securing the most efficient pumping equipment for unwatering work.
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STOP!

IF YOU USE PUMPS

send for this booklet

IT WILL SAVE YOU MONEY on your next wet job.

It's free for the asking

Ralph B. Carter Co.

192 Atlantic St., Hackensack, N. J.

Equipment for the Sanitary Engineer

Rapid Method of Expelling Sewer Gas

For overcoming the hazards of manhole work by expelling carbon monoxide gas a Coppus Vano blower has been employed by the Street Department of the City of New York.

It is a light weight blower and easily portable, weighing less than 100 pounds, and does the work of the older and more cumbersome methods employed, in but a fraction of the time.

An average comparison of the time saved is found in a job that formerly required one-half hour or more to expel the gas but which is now accomplished with the Coppus blower in approximately five minutes time.

Additional data may be had on this equipment by writing direct to the Coppus Engineering Corporation at Worcester, Mass., who make a complete line of blowers and exhausters for all industries.

—DOES YOUR COMMUNITY NEED MORE WATER?—BUILD NOW

Omega Universal Chemical Feeders

The Omega Machine Co., 4010 Penn avenue, Kansas City, Mo., manufacture a machine for feeding and measuring all dry chemicals used in water treatment. and also other lump, granular or pulverized materials. These machines are made in three sizes for handling from one pound to several carloads per day. Operation is through a motor-driven gear which transmits oscillations to a hopper.

PUBLIC WORKS CONSTRUCTION RELIEVES UNEMPLOYMENT—

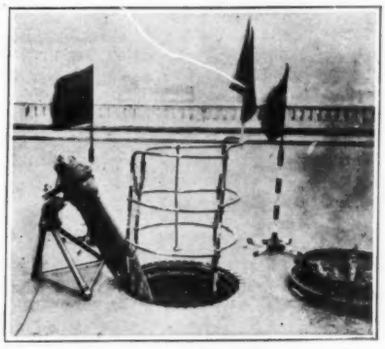
Orthotolidin Test Controls Chlorine in New W & T Chlorinator

An entirely new principle in automatic control of chlorination has been developed by Wallace and Tiernan Co., Newark, N. J. The orthotolidin test, generally accepted as the criterion of correct chlorinator operation, positively controls chlorine flow with this apparatus. The tests are automatically made at ten minute intervals and "residual chlorine" of the treated water recorded on a chart.

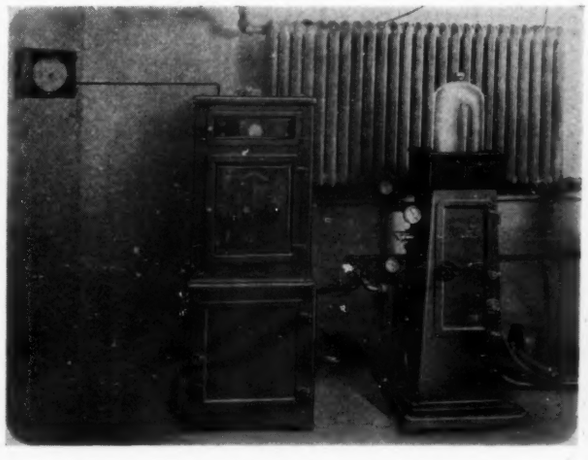
Any fluctuations in flow or chlorine demand are reflected in varied "residuals" and immediately compensated for by the Automatic Controller. Recorded "residual chlorine" curves show no appreciable lag between chlorine demand and automatic adjustment of chlorine flow.

As a forward stride in the art of chlorination, it is the most outstanding in recent years. As a safeguard against sudden and unheralded pollution, its value to water works operators cannot be overestimated. The charted curve is a permanent record of positive and complete chlorination.

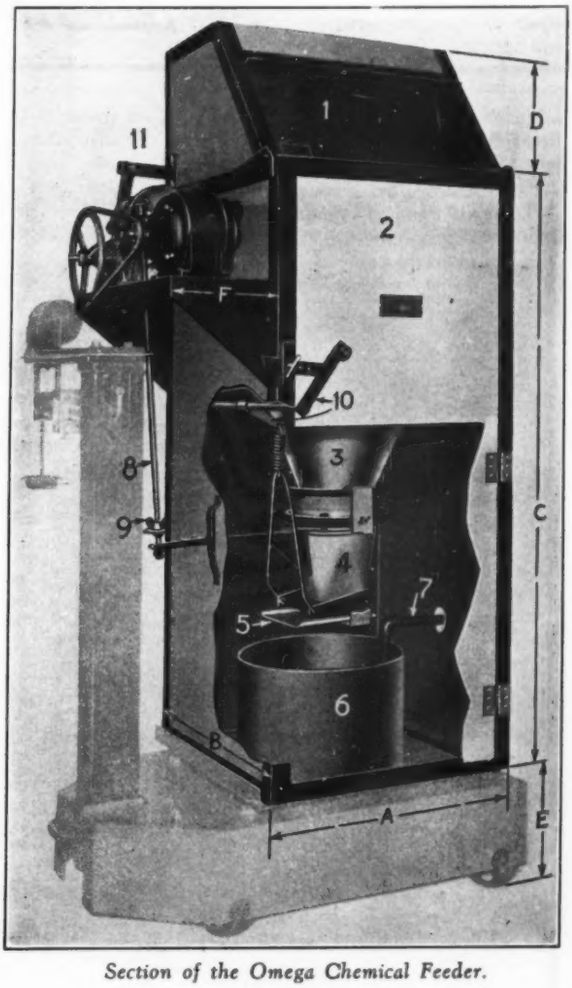
This apparatus is available as a full automatic "residual chlorine" controlled automatic chlorinator or the residual recording unit may be secured separately and used in conjunction with existing chlorinator equipment.



Coppus Blower.



Wallace & Tiernan Ortho Control Apparatus.



Section of the Omega Chemical Feeder.

Recent Publications

(Use form on page 93)

Layne Pumps.—An illustrated folder issued by Layne & Bowler, Memphis, Tenn., describes the new Layne vertical centrifugal pump and tells about Layne water service.

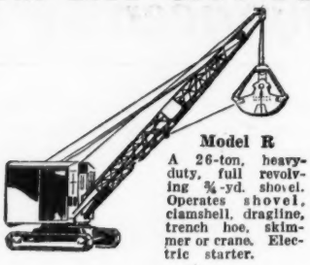
BUILD NOW—

Automatic Control.—The Brown instrument Co., Philadelphia, Pa., has issued an elaborate 32-page booklet on "Automatic Control" which contains a good deal of information regarding applications of automatic remote control.

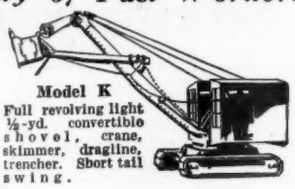
BUILD NOW—

Portable Chlorinators.—The Paradon Manufacturing Company, Arlington, N. J., have issued a new Bulletin No. 22 describing the Paradon Type "P" portable chlorinator. This is a standard Paradon chlorinator mounted in a fibre carrying case, and can be used for permanent jobs as well.

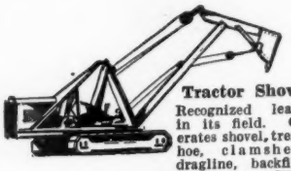
The BAY CITY *Family of Fast Workers*



Model R
A 26-ton, heavy-duty, full revolving ¾-yd. shovel. Operates shovel, clamshell, dragline, trench hoe, skimmer or crane. Electric starter.



Model K
Full revolving light ½-yd. convertible shovel, crane, skimmer, dragline, trencher. Short tail swing.



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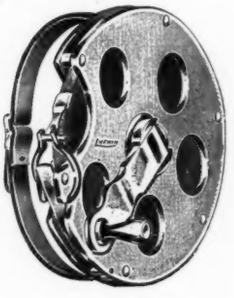

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By combining the elements of crane and compressor into a single, compact, mobile unit, Frederic H. Poor, Inc., has produced a device which, because of its ability to play a dual role, lends itself to continuous service. Mounted on a McCormick-Deering 10-20 Industrial Tractor, the Loadmaster crane is of value to public utilities, contractors, municipalities and railroads. This crane affords an easily maneuvered, extremely mobile form of hoist. It is fitted with a 10, 12, or 14 ft. boom as required, and is rated at 3,500 lbs. capacity. The revolving boom affords great facility in the swinging and "spotting" of loads.

These advantages have now been extended by the addition of a 160-cu. ft. capacity air compressor, mounted, as integral part of the unit on the rear of the tractor, the air tank being carried on the left side of the body of the crane. This compressor is capable of taking care of three paving breakers, four riveting hammers or two rock drills.

A compressor carried thus needs no hauling, is more easily maneuvered than the usual form of compressor mounted on an individual chassis and, owing to the Loadmaster's ability to keep moving abreast of its job, is not apt to call for abnormal lengths of vulnerable hose.

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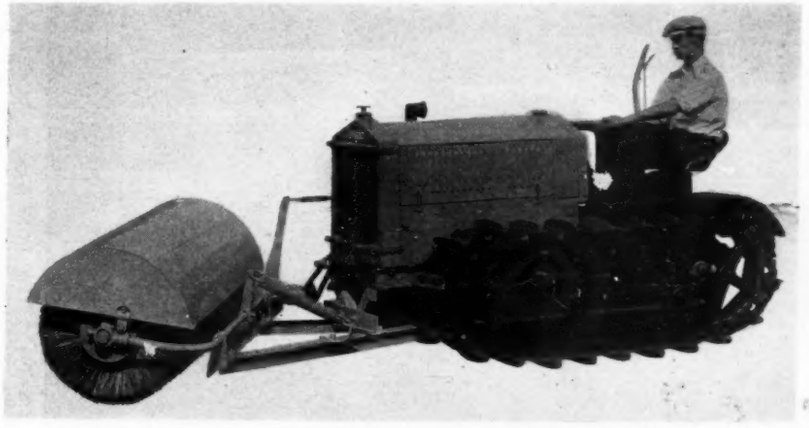
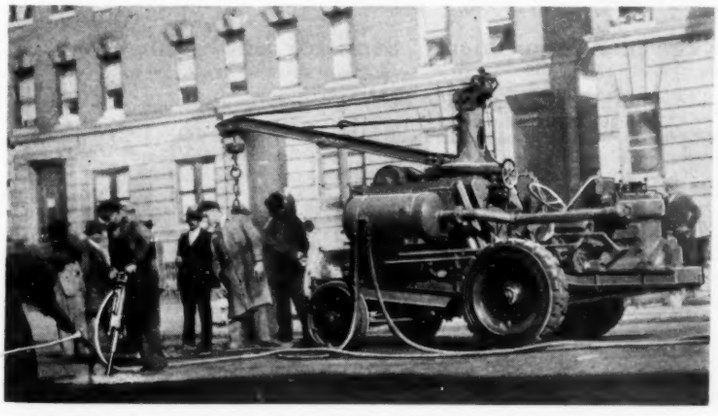
Detroit Sweeper and Snow Brush

The Detroit Harvester Co., Detroit, Mich., manufacture the Detroit sweeper and snow brush which weighs less than 700 pounds and can be attached without any alteration to the Cletrac 20 Tractor. The Cletrac 20 Tractor equipped with the Detroit Street Sweeper and Snow Brush makes a most efficient, practical and economical unit for general street cleaning work. Municipal officials, state and county road commissioners, transportation engineers, plant traffic men will find many uses for this tractor-driven unit.

The Detroit Brush is particularly valuable during the winter months after falls of snow. It will handle snow ten to twelve inches in depth, making a clean sweep and keeping a path clear for the tractor.



The Detroit Street Sweeper and Snow Brush.



Loadmaster Crane and Compressor Combination.

New Equipment Data

Rollers.—The Austin-Western Road Machinery Co., 400 No. Michigan Ave., Chicago, Ill., has published an illustrated folder showing its full line of 1930 road rollers.

—BUILD NOW—

Mules vs. Cats.—American Tractor Equipment Co., Oakland, Calif., has published a booklet which should be of interest to every engineer or contractor concerned with earth-moving.

—GOOD ROADS WERE NEVER CHEAPER

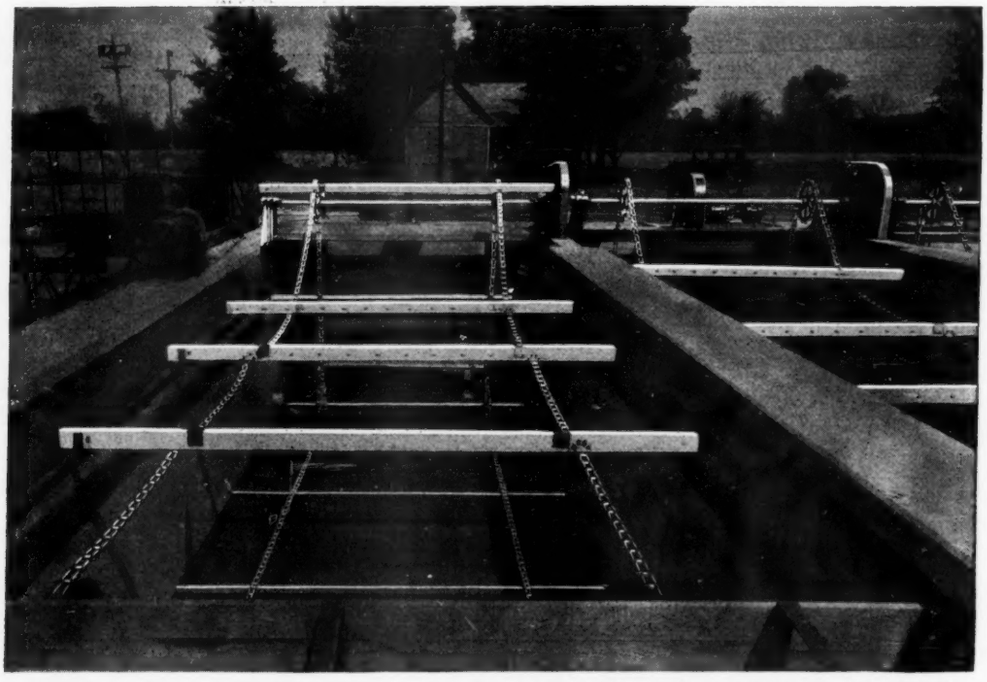
Pneumatic Tools.—The Chicago Pneumatic Tool Co., New York, has published catalog 563, 82 pages, illustrated, which describes and gives details of pneumatic tools and accessories. Bulletin 865 describes demolition tools and sheeting drivers, which are made in a handy variety of sizes. Bulletin 797 covers thoroughly the subject of portable air compressor use and construction. No. 798 covers vertical compressors, and 850 describes the C-P line of sinker drills.

—ROADS—NOW IS THE TIME TO BUILD

Half-Yard Shovel.—The 1020, Bucyrus-Erie's ½-yard convertible clamshell, lifting crane, shovel, dragline and dragshovel is fully described and illustrated in an attractive bulletin. Smallest of the Bucyrus-Erie line, this machine may be had with gasoline, Diesel or electric power plants. A copy of this catalogue may be obtained by anyone interested. Address requests to Bucyrus-Erie Company, South Milwaukee, Wis.

The New Greaseal Bearing of the Norma Hoffman Bearings Corporation.

For the POSITIVE REMOVAL OF SLUDGE



Springfield, Ill. Showing two of three primary settling tanks with Straightline Collectors, at the activated sludge plant.
Pearce, Greeley & Hansen, Consulting Engineers.

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SINCE this plant was started there has never been a failure of any kind in the operation of the Link-Belt STRAIGHTLINE Collectors in the removal of sludge from the settling tanks.

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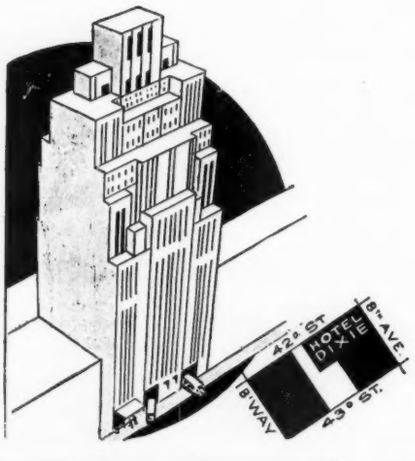

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News From the Engineering Field

American Road Builders' Association

Officers Nominated for the Coming Year—Plans for the Road Show—Committee Reports

Official nominations for officers for 1931-1932 and directors for three years have been submitted by the Nominating Committee as follows: *For President*: Wm. R. Smith, President, Lane Construction Corporation, Meriden, Conn.; *For Vice Presidents*: Samuel Eckels, Chief Engineer, Pennsylvania Department of Highways, Harrisburg, Pa.; H. G. Shirley, State Highway Commissioner, Richmond, Va.; S. F. Beatty, President, The Austin-Western Road Machinery Co., Chicago, Ill.; Samuel Hill, Honorary Life President, Washington State Good Roads Association, Seattle, Wash.; *For Treasurer*: James H. MacDonald, Consulting Road and Paving Expert, New Haven, Conn.; *For Directors: Term ending 1934:* H. K. Bishop, Chief Division of Construction, U. S. Bureau of Public Roads, Washington, D. C.; Robert B. Brooks, Director of Streets and Sewers, **St. Louis, Mo.**; Paul L. Griffiths, Vice-President, American Tar Products Co., Pittsburgh, Pa.; A. Lee Grover, Secretary, New Jersey State Highway Commission, Trenton, N. J.; Richard Hopkins, Contractor, Troy, N. Y.; J. E. Pennybacker, Managing Director, The Asphalt Institute, New York, N. Y.; H. C. Whitehurst, Engineer of Highways, District of Columbia, Washington, D. C.

City Officials' Division

For Vice-Presidents — Albert T. Rhodes, superintendent of streets and sewers, Leominster, Mass.; W. E. Sheddan, city engineer, Jacksonville, Fla.; Robert B. Brooks, director of streets and sewers, St. Louis, Mo.; Walter S. Wheeler, city engineer, Dover, N. H. (in place of W. D. Barkhoff, deceased).

For Directors, Term Ending 1934—D. L. Erickson, city engineer, Lincoln, Nebr.; L. W. Herzog, commissioner of public works, Albany, N. Y.; H. W. Kueffner, director of public works, Durham, N. C.; H. C. McClure, city engineer, Flint, Mich.; Geo. C. Stanley, city engineer, Burlington, Vt.; J. M. Tippee, city engineer, Des Moines, Iowa; Bryson Vallas, city engineer, New Orleans, La.

County Highway Officials' Division

For Vice-Presidents—H. B. Keasbey, county engineer, Salem County, Salem, N. J.; W. O. Washington, county engineer, Cameron County, Brownsville, Tex.; H. G. Sours, county engineer, Summit County, Akron, Ohio; George W. Jones, county superintendent of highways, Los Angeles County, Los Angeles, Calif.

For Directors, Term Ending 1934—W. W. Brandon, county commissioner, Tuscaloosa County, Tuscaloosa, Ala.; Chas. A. Browne, chief engineer, Orange County, Orlando, Fla.; E. A. Griffith, chief engineer of roads, Allegheny County, Pittsburgh, Pa.; Eugene L. Gates, superintendent of highways, Du Page County, Wheaton, Ill.; L. O. Marden, county engineer, Worcester County, Worcester, Mass.; J. W. Mavity, county engineer, Harvey County, Newton, Kans.; J. C. McLean, county engineer, Woodbury County, Sioux City, Iowa.

Equipment

Equipment is an important item in the totals of highway cost. An estimated $2,000,000,000 was spent by the nation last year for highways. Of this amount, some 10%, or $200,000,000, probably went for rental and purchase of equipment. The study of equipment has been divided into six sections to take up special investigations. The final reports will be drafted and presented at the twenty-eighth annual convention and road show of the American Road Builders' Association in St. Louis, January 10-16, 1931.

Snow removal is the subject of one group whose chairman is W. F. Rosenwald, maintenance engineer, Minnesota state highway department. This committee is investigating all types of such equipment; methods, which vary in cities and rural highways; snow control by fences and other devices; use of chemicals in elimination of ice on pavements; spreading of sand or cinders over busy streets on packed snow; use of heaters to thaw snow; amount of snowfall in various states and expense of removal. An airport engineer will discuss the safety hazard presented by snowfall on airports and the problem of its disposal.

Guard Rails

The guard rail committee is seeking creation of standards for various types of guard rail on which state highway departments may agree. A three-month survey has already been made with a view to standardizing the different types for the specific use to which they are to be put. The survey included a questionnaire sent to all state highway departments. Data from this source and from tests made by the Pennsylvania state highway department and by various manufacturers is already possessed by the committee.

The guard rail committee will include representatives of manufacturers of timber, wooden posts with cable, concrete posts with cable, timber posts with hub-high wooden rail and cable, mesh guard rail, chain link or woven wire and special patented types.

Grading

The committee on grading methods and grading equipment, of which H. J. Spelman, chief engineer, West Virginia state highway department, is chairman, will confine its work to a study of the construction and compaction of embankments. A staff engineer has made a tour to study soils, hydraulic fills, use of tractors and rollers for compaction, and other equipment and methods. All sources of information will be utilized to solve what is viewed as one of the important problems of road building.

Maintenance

Equipment for cleaning ditches and culverts, for clearing weeds on the rights-of-way, for picking up foreign materials on the highways, and insulated freight cars for shipping oils and tars for road use at usable temperatures, are among the unusual subjects to be studied by the committee section on needs for and availability of maintenance equipment.

R. L. Cochran, Nebraska, state highway engineer, is chairman of this group which is collecting data on **maintenance**

December 11-12—HIGHWAY RESEARCH BOARD. Annual meeting at Washington, D. C. Roy W. Crum, director, 21st and B streets, Washington, D. C.

January 9-12—NATIONAL ASSOCIATION OF PARIS TRANSIT MIXED CONCRETE MANUFACTURERS. Annual convention in St. Louis, Mo. E. A. Landis, Executive Secretary, E. Water and E. Salmon Sts., Portland, Oregon.

January 12-17—Road Show and ARBA Convention at St. Louis, Mo. C. M. Upham, National Press Bldg., Washington, D. C.

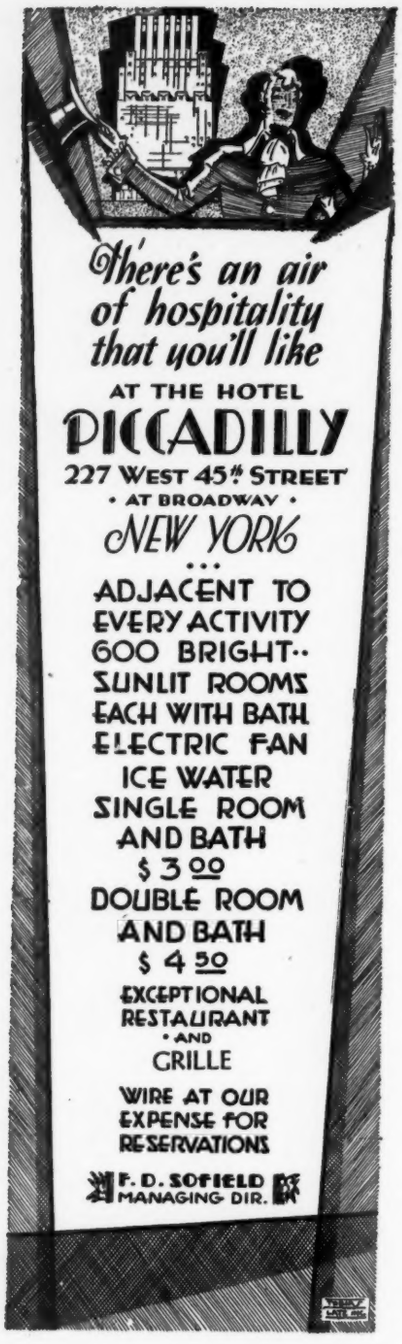
January 21-23—AMERICAN SOCIETY OF CIVIL ENGINEERS. Annual convention at New York. George T. Seabury, Secretary, 33 West 39th St., New York.

February 4-6—NATIONAL PAVING BRICK MANUFACTURERS' ASSOCIATION. 25th annual meeting at William Penn Hotel, Pittsburgh, Pa. George F. Schlesinger, chief engineer and managing director, National Press Building, Washington, D. C.

February 18-20—ASSOCIATION OF HIGHWAY OFFICIALS OF NORTH ATLANTIC STATES. Seventh Annual Convention at Ambassador Hotel, Atlantic City. N. J. A. Lee Grover, Secretary, State Highway Commission, Trenton, N. J.

February 24-27—SIXTH ANNUAL SOUTHWEST ROAD SHOW AND SCHOOL at Wichita, Kans. F. G. Wieland, Manager, Wichita, Kans.

May 25-29—AMERICAN WATER WORKS ASSOCIATION. Annual convention at Pittsburgh, Pa. Beekman C. Little, Secretary, 29 West 39th Street, New York, N. Y.



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equipment and methods on four road types: earth surface, gravel surface, surface treated, and pavement surface; on maintenance of bridges, snow removal, and general maintenance.

Pavements

Interesting and valuable studies about the financing, construction, maintenance and use of city pavements are in progress by the City Officials' Division of the American Road Builders' Association. Reports giving the results of these studies will be presented at the Annual Convention and Road Show of that Association to be held in St. Louis, January 12-16, 1931.

These studies include a detailed investigation of conditions in 20 representative cities with regard to: 1. Assessment practice for pavements. 2. Design and construction of pavements. 3. Maintenance of city streets of all types, including snow removal and street cleaning. 4. Street capacities.

The purpose of these studies is to effect standardization of methods so that economies may be accomplished in the financing, construction, maintenance and use of city pavements.

Chairmen of the four City Officials' Committees who will present the committee reports are: Capt. H. C. Whitehurst, Coordinator and Chief Engineer, District of Columbia, Washington, D. C.; George B. Sowers, Commissioner, Division of Engineering and Construction, Cleveland, Ohio; A. T. Rhodes, Superintendent, Streets and Sewers, Leominster, Massachusetts; M. O. Eldridge, Assistant Director of Traffic, Washington, D. C.; Col. C. E. Myers, Director of Transit, Philadelphia, Pennsylvania, is President of the City Officials' Division.

—GOOD ROADS WERE NEVER CHEAPER—BUILD NOW—

National Paving Brick Manufacturers Association

The twenty-fifth annual meeting of the National Paving Brick Manufacturers Association will be held at the William Penn Hotel, Pittsburgh, Pa., February 4-5-6, 1931. The program for the last two days will include papers and discussions of the latest practices in the design and construction of streets and highways, particularly the vitrified brick type. These sessions will be open to the general public and any one interested in street and highway development is invited to attend.

The program, now under preparation, will be presented by prominent engineers and paving authorities. It will include descriptions of recently constructed brick super-highways and discussions of such subjects as the resurfacing of old pavements with vitrified brick; the salvaging of old brick in reconstruction projects; fillers for vitrified brick pavements; efficient management of brick paving contracts; and highway research applied to brick pavements.

The annual banquet will be held Thursday night, February 5th, and business conferences will be held on the first day of the meeting.

George F. Schlesinger, formerly State Highway Director of Ohio, is Chief Engineer and Managing Director of the National Paving Brick Manufacturers Association.

—ROADS—BUILD THEM AND PROSPER—

Association of Highway Officials of the North Atlantic States

The seventh annual convention of this association will be held at Atlantic City, N. J., February 18-20, 1931. The Hotel Ambassador has been designated as headquarters for the convention and all the exhibits, and Hotel Chelsea as joint headquarters. A. Lee Grover, secretary of the New Jersey State Highway Commission, Trenton, N. J., is secretary of the association.

—ROADS—NOW IS THE TIME TO BUILD THEM—

Missouri Water and Sewerage Conference

Problems in the design and operation of municipal water works and sewerage systems were taken up in detail at the Sixth Annual Meeting of the Missouri Water and Sewerage Conference, held in Columbia, October 23-24-25.

The following officers were elected for the coming year: Chairman, J. N. Wells, Supt., Joplin Water Works, Joplin; Vice-Chairman, E. E. Wolfe, City Chemist, Hannibal; Secretary-Treasurer, H. D. Peters, Assistant Public Health Engineer, State Board of Health, Jefferson City. Executive Committee: R. L. Barker, Supt. Water Works, Odessa; O. L. Hebbler, Supt. Water Works, Higginsville; Hugh Brown, Supt. Water Works, Vandalia; Wm. J. Gray, Supt., Springfield City Water Company, Springfield.

—DOES YOUR COMMUNITY NEED MORE WATER? —BUILD NOW

Highway Research Board

The Tenth Annual Meeting of the Highway Research Board will be held in Washington, D. C., on December 11 and 12, 1930. The tentative list of research reports to be presented is:

Committee Reports. — Highway Finance; An Analysis of Cost of Transportation on Two Roads—One in Iowa and the Other in Connecticut; Determination and Classification of the Important Characteristics of Bitumen For Use in Surface Applications, Mixed-In-Place Surfaces, etc.; Developments in Construction Methods and Appliances; Durability of Aggregates; Effect of Flat and Elongated Particles in Aggregates; Effect of Dust Coatings on Aggregates; Maintenance Costs; Method for Rectifying Pavement Settlement; Ice Removal; Filler for Brick and Block Pavements; Traffic Control Mechanisms; Traffic Capacity; The Accident-Prone Driver; Traffic Survey Methods and Forms; Financial Responsibility; Vehicle and Highway Mechanics as Related to Traffic; Extent of Desirability For State Control of Traffic Regulation in Municipalities; Law Observance and Enforcement Methods.

Engineering Library

DEC 13 1930

PUBLIC WORKS

CITY COUNTY STATE

CHEAP money, low cost of labor and materials, and the political advantage of providing work for the many who need it are compelling reasons for increased public construction during the season of 1931. Tax monies stand at approximately the same volume as in the past two or three years. In addition, through tax anticipation notes, money can be raised easily when needed, which was not the case a year ago. Bond interest rates are now low, and public improvements effected through this means impose no immediate material burden upon taxpayers.

It would be a sad commentary upon the vision and courage of our city, county, township and village officials if they should take this period to reduce public works expenditures. Not only would they fail to take advantage of the most favorable period, from the dollars and cents viewpoint, but they would fail their own citizens. In every community, a considerable portion of such construction costs go directly to citizens of that community; and the benefit of the construction goes almost entirely to them.—*See page 35*

DECEMBER, 1930

Testimonial:

City of Danville, Illinois, cleans streets dustlessly with Austin Motor Sweeper. *Overhead*: 5 gallons of gas plus $4 a day for operation and *$52.20 for repairs in 3 years!*

CITY OF DANVILLE
DANVILLE, ILLINOIS

C. SCHATZ, COMMISSIONER OF FINANCE
W. H. SMITH, COMMISSIONER OF PUBLIC HEALTH AND SAFETY
HENRY MULCE, Mayor
W. F. SHEETS, COMMISSIONER OF STREETS AND PUBLIC IMPROVEMENTS
W. C. KINGSBURY, COMMISSIONER OF PUBLIC PROPERTY

Danville, Illinois
July 14, 1930

Mr. Fayette Merrill,
City Clerk,
Des Plaines, Illinois.

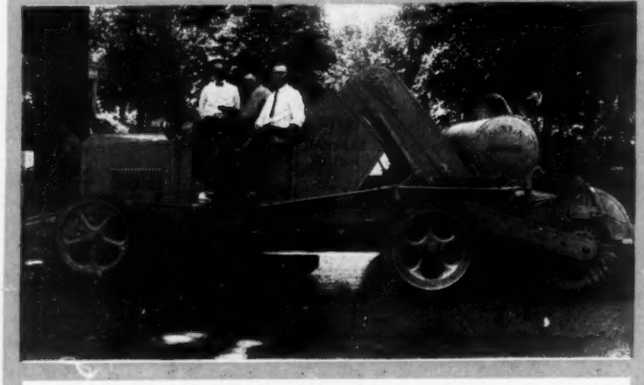
Dear Sir:

In reply to your letter of July 11th, requesting information in regard to the "Austin Sweeper," wish to state that we have an "Austin Sweeper" in the City of Danville, Illinois, and it has given us perfect satisfaction. We employ one man to operate this sweeper @ 50¢ per hour for eight hour work per day; we use fifteen gallon of gasoline in twenty-four hour run, and two gallon of oil every three to four weeks. We have had this sweeper nearly three years and to date we have only spent $52.20 for repairs.

Hoping that the above gives you the desired information, I am

Yours very truly,
W F Sheets
Commissioner of Streets and Public Improvement.

Recommendation for Austin Motor Sweeper of Mr. W. F. Sheets, Commissioner of Streets and Public Improvement of the City of Danville, Illinois.

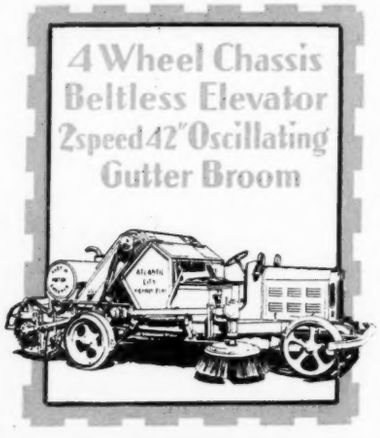


Three year old Austin Motor Sweeper at Danville—a progressive community of 38,000

WE have numerous unsolicited testimonials like this on the Austin Motor Pick-Up Sweeper in our files. There are countless others that we never hear of except when some municipal official laughingly tells an Austin-Western man that what really sold him on our sweeper was the enthusiasm of Commissioner So-and-so of such-and-such a city for *his* Austin.

This good will that Austin Motor Sweepers are steadily building is important evidence that they meet every expectation of their purchasers as is also the growing list of progressive cities and towns using more than one Austin Motor Sweeper.

The Austin Motor Pick-Up Sweeper performs all the functions of street cleaning at lowest cost. It first sprays the dust, then automatically sweeps up all dirt and deposits it in a hopper. Sweepings are then carried to a designated dumping place. Only one man is required for all these operations. Most important of all is the fact that the Austin Motor Pick-Up Sweeper cleans streets thoroughly from curb to curb without raising dust. For more information on this efficient way to reduce costs and raise standards of street cleaning, write The Austin-Western Road Machinery Co., 400 N. Michigan Ave., Chicago, Illinois. Branches in principal cities.



Austin-Western
ROAD MACHINERY

VOL. 61 No. 12
Entered as second-class matter at the Post Office at New York, N. Y., Sept. 1, 1922, under the Act of March 3, 1879.
Published monthly by PUBLIC WORKS JOURNAL CORPORATION, 310 East 45th St., New York, N. Y.
Subscription price $3.00 a year. Single copies 35 cents.

• SWEEP

WITH A "CATERPILLAR"

YOU can sweep streets with a "Caterpillar" Tractor and you can use the same tractor to roll the municipal airport or level bumpy streets or build new roads or plow snow—for dozens of useful jobs. Wide, long tracks that ride mud or sand or asphalt; long life and generous power—these are "Caterpillar" characteristics. Better parks and streets, better municipal airports and golf courses—these come to a city when the "Caterpillar" is delivered.

Prices—f. o. b. Peoria, Illinois

TEN	$1100
FIFTEEN	$1450
TWENTY	$1900
THIRTY	$2375
SIXTY	$4175

Caterpillar Tractor Co.

PEORIA, ILL. *and* SAN LEANDRO, CALIF., U. S. A.

Track-type Tractors Combines Road Machinery

(There's a "Caterpillar" Dealer Near You)

CATERPILLAR REG. U.S. PAT. OFF.

The *classified* INDUSTRIAL LITERATURE section is your guide to the latest catalogs—see page 93

ALUMINUM SULPHATE

As Filter Alum this standard product of General Chemical Company meets every requirement of the water-works of the nation. The purity and uniformity which commend it for water purification make this Company's product equally preferable in paper mills and with other users. Stocked at and shipped from a country-wide chain of plants and stations.

Among this Company's products are:

SULPHURIC ACID
Oil of Vitriol—Oleum—Mixed Acid—Battery Acid

MURIATIC ACID
(Hydrochloric Acid)

NITRIC ACID

ACETIC ACID
Commercial, Redistilled, Pure and Glacial

And other Heavy Chemicals of Standard Purity

Reagent Chemicals

INSECTICIDES
FUNGICIDES

GENERAL CHEMICAL COMPANY

40 RECTOR ST., NEW YORK

Cable Address, Lycurgus, N.Y.

BUFFALO · CHICAGO · CLEVELAND · DENVER
LOS ANGELES · PHILADELPHIA · PITTSBURGH
PROVIDENCE · SAN FRANCISCO · ST. LOUIS

THE NICHOLS CHEMICAL COMPANY, LIMITED, MONTREAL

For durability and economy, LOUISVILLE lays *Cast Iron* water mains exclusively

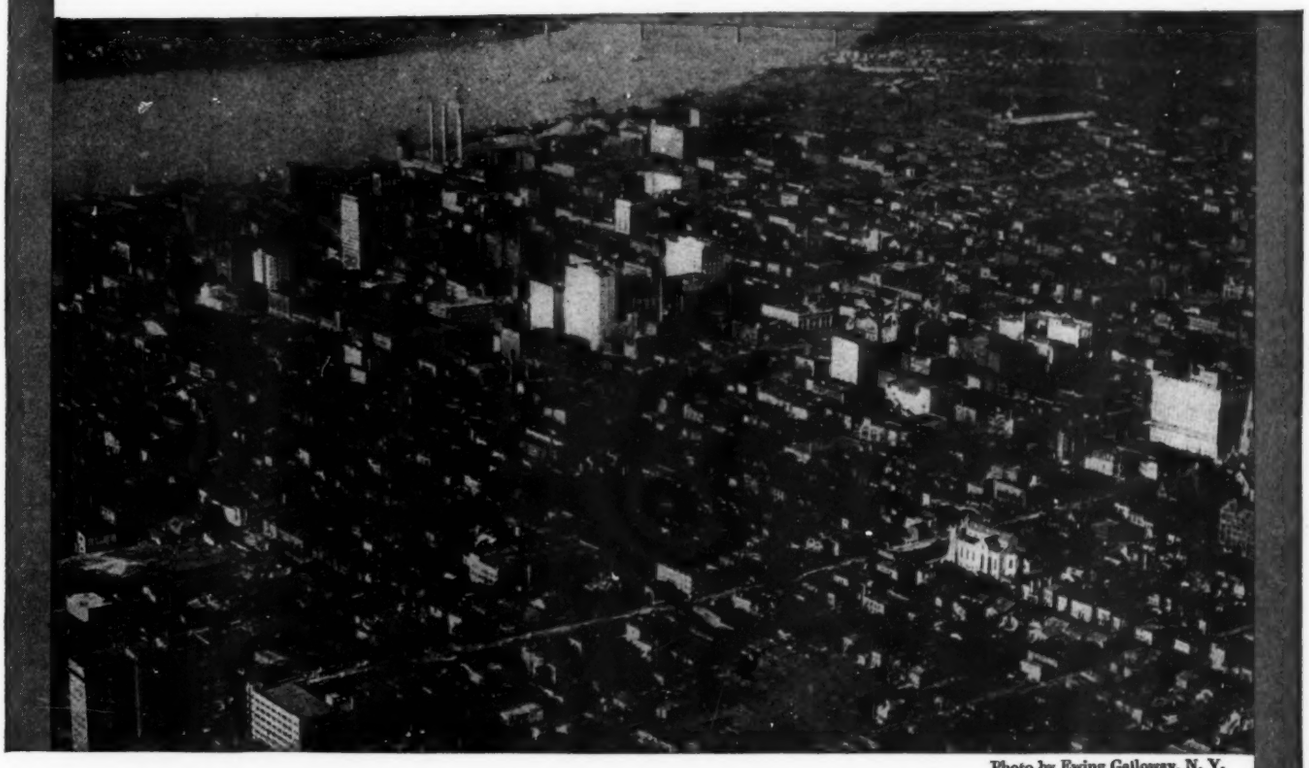


Photo by Ewing Galloway, N. Y.

"THE first cast iron pipe in Louisville was laid in 1860," writes Mr. John Chambers, Superintendent of the Louisville Water Co. "This pipe is still in service. We have no mains that are not of cast iron. Our mains vary in size from four inches to seventy-two inches in diameter."

The splendid performance, low maintenance costs and great durability of cast iron pipe have proved the wisdom of using cast iron mains exclusively. In regard to large diameter pipe, Louisville finds cast iron particularly economical. Many other cities endorse Louisville's judgment. In fact, during the past year, more large diameter cast iron pipe was produced than ever before.

The reason for the durability of cast iron pipe is its effective resistance to rust and corrosion. Water and gas mains of ferrous metal (iron and steel) with the exception of cast iron, disintegrate from rust.

Cast iron pipe is the only ferrous metal pipe practicable for underground mains which rust will not destroy.

For complete information regarding the economy of specifying cast iron pipe for water, gas, sewers, culverts or industrial needs, write to Thomas F. Wolfe, Research Engineer, 309 Peoples Gas Building, Chicago, Illinois.

✣ ✣ ✣

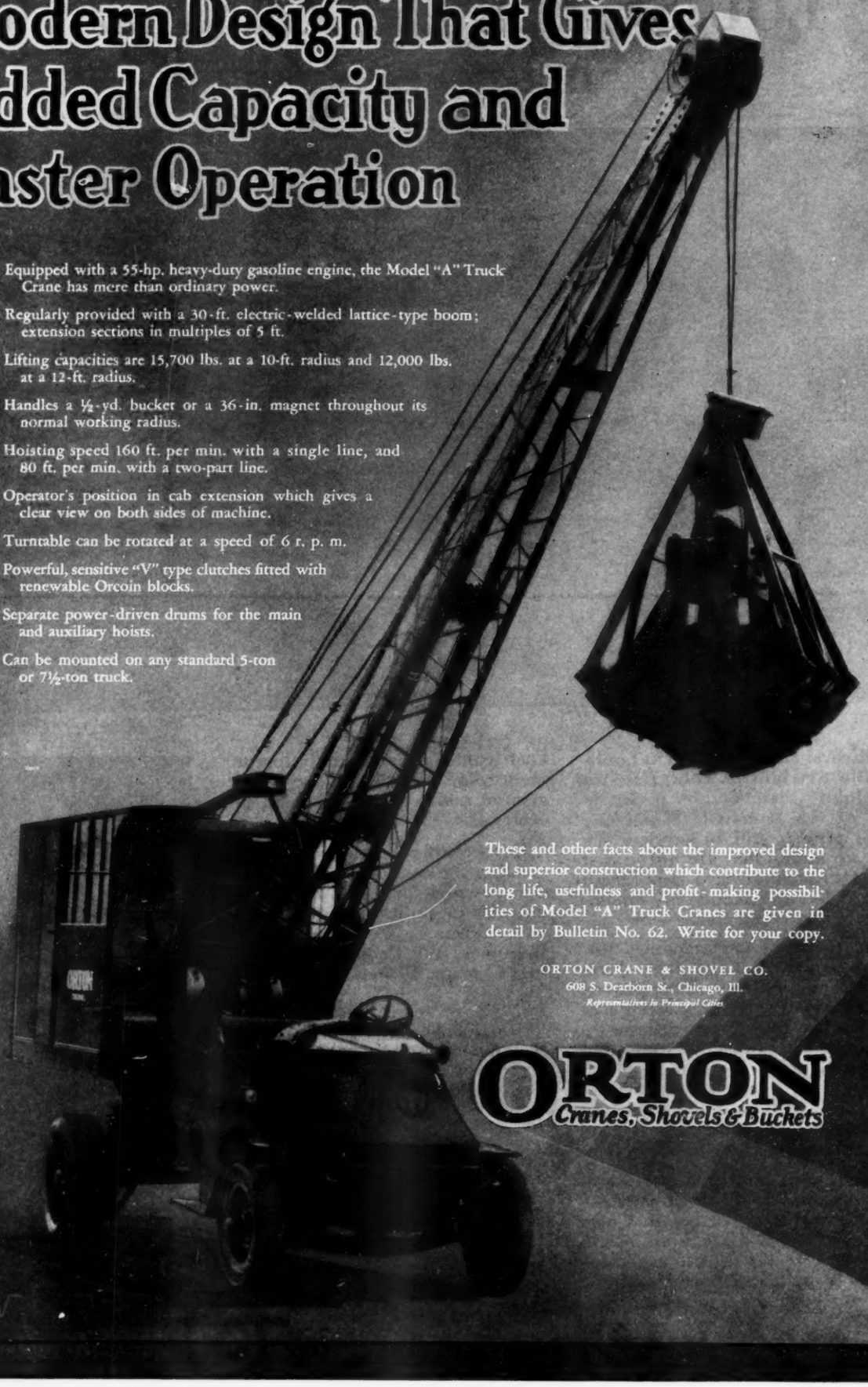
Cast iron pipe bearing the "Q-check" trade mark is obtainable from the following leading pipe founders: Alabama Pipe Company, Anniston, Ala.; American Cast Iron Pipe Company, Birmingham, Ala.; James B. Clow & Sons, 219 N. Talman Avenue, Chicago, Ill.; Donaldson Iron Company, Emaus, Pa.; Glamorgan Pipe and Foundry Company, Lynchburg, Va.; Lynchburg Foundry Company, Lynchburg, Va.; National Cast Iron Pipe Company, Birmingham, Ala.; United States Pipe and Foundry Company, Burlington, N. J.; Warren Foundry and Pipe Company, 11 Broadway, New York.

Engineers inspecting the installation of a large diameter cast iron main in Louisville, Kentucky.

The "Q-check" symbol shown above has been adopted as the trade mark of The Cast Iron Pipe Research Association.

CAST IRON PIPE

Modern Design That Gives Added Capacity and Faster Operation



Equipped with a 55-hp. heavy-duty gasoline engine, the Model "A" Truck Crane has more than ordinary power.

Regularly provided with a 30-ft. electric-welded lattice-type boom; extension sections in multiples of 5 ft.

Lifting capacities are 15,700 lbs. at a 10-ft. radius and 12,000 lbs. at a 12-ft. radius.

Handles a ½-yd. bucket or a 36-in. magnet throughout its normal working radius.

Hoisting speed 160 ft. per min. with a single line, and 80 ft. per min. with a two-part line.

Operator's position in cab extension which gives a clear view on both sides of machine.

Turntable can be rotated at a speed of 6 r. p. m.

Powerful, sensitive "V" type clutches fitted with renewable Orcoin blocks.

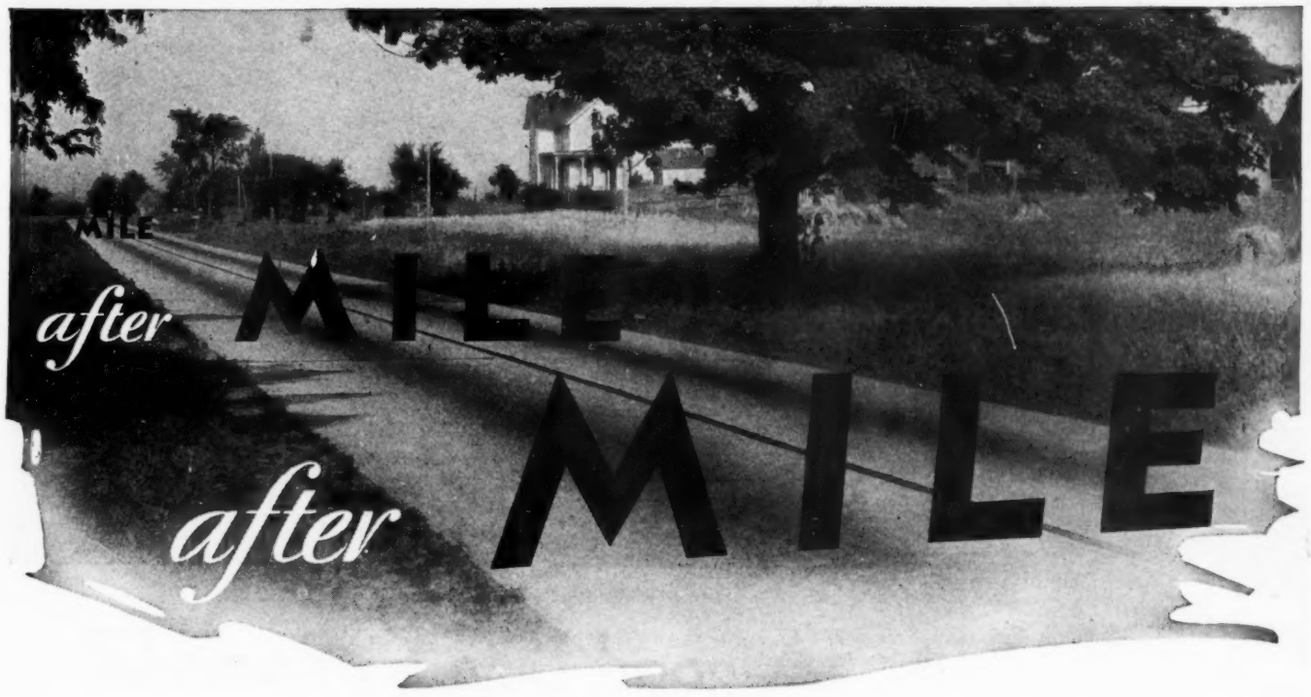
Separate power-driven drums for the main and auxiliary hoists.

Can be mounted on any standard 5-ton or 7½-ton truck.

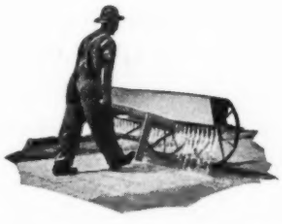
These and other facts about the improved design and superior construction which contribute to the long life, usefulness and profit-making possibilities of Model "A" Truck Cranes are given in detail by Bulletin No. 62. Write for your copy.

ORTON CRANE & SHOVEL CO.
608 S. Dearborn St., Chicago, Ill.
Representatives in Principal Cities

ORTON
Cranes, Shovels & Buckets



. . . . and all that's needed for the curing job is one man, a spreader, and some Calcium Chloride . . . . . .



Method of curing concrete by the use of Calcium Chloride on the surface or as an admixture are both approved by the United States Bureau of Public Roads.

No big final clean-up is needed where concrete roads are cured with a surface application of Flake Calcium Chloride. After the man with the spreader applies the Flake Calcium Chloride on the surface, this clean white material takes care of itself just as it takes care of the entire curing operation. No need for constant sprinkling and inspection, either.

No wonder Calcium Chloride has been chosen to do the curing job on thousands of miles of the best concrete highways. Besides assuring perfect curing, the Calcium Chloride methods provide advantages that appeal to everyone concerned with a concrete road, from the men who plan and build it to the taxpayers who pay for it and use it.

The full facts are presented in the information which will be furnished by any of the companies sponsoring this advertisement. Write today and ask for booklet 842.

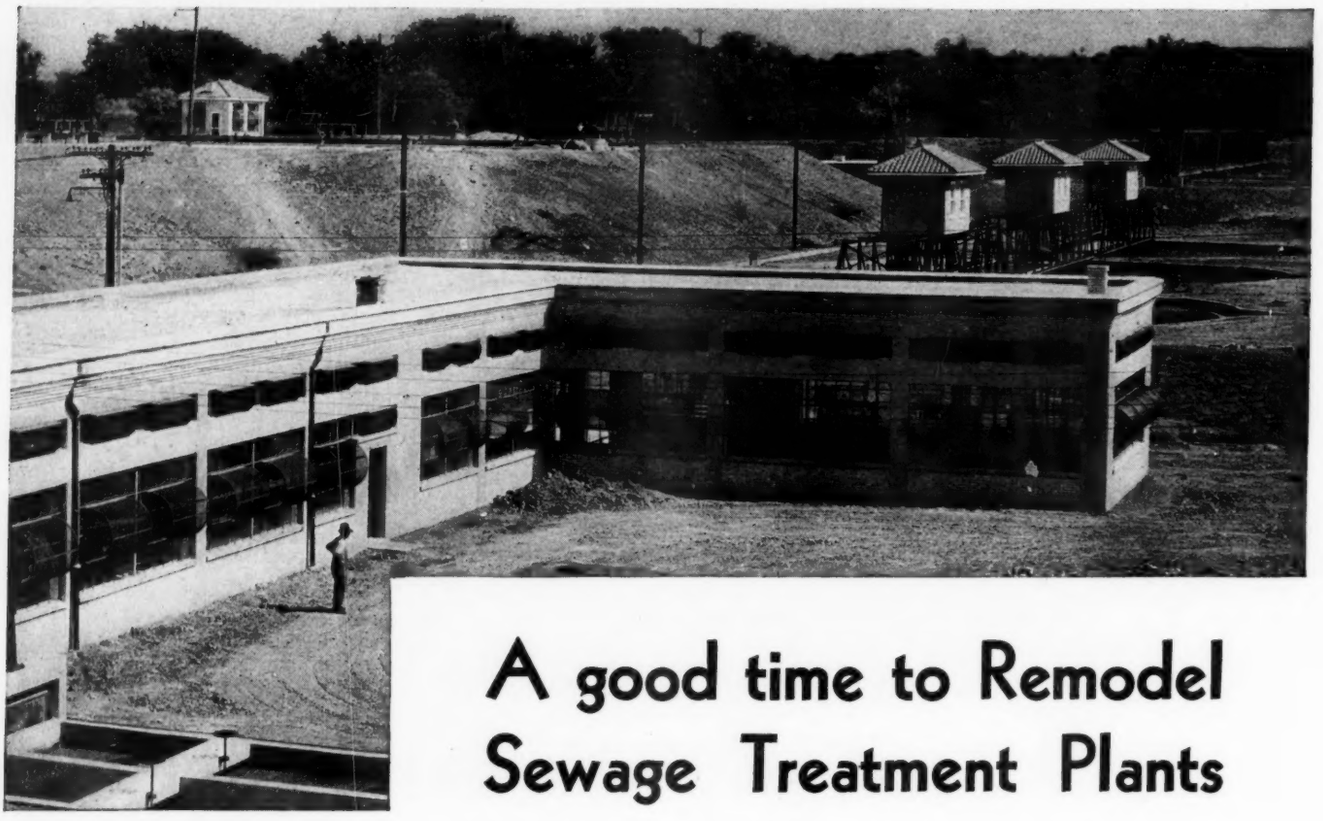
CALCIUM CHLORIDE PUBLICITY COMMITTEE
SOLVAY SALES CORPORATION - - - - - - - - - 61 Broadway, New York
THE COLUMBIA PRODUCTS COMPANY - - - - - - - - Barberton, Ohio
THE DOW CHEMICAL COMPANY - - - - - - - - - - Midland, Michigan

FLAKE

CALCIUM CHLORIDE

CURES CONCRETE

The *classified* INDUSTRIAL LITERATURE section is your guide to the latest catalogs—see page 93



A view of the sewage treatment plant at Fort Worth, Texas. When this plant was originally built, two Dorr Clarifiers were installed for sedimentation of trickling filter effluent. Recent changes included the installation of a Dorrco Bar Screen, of four Dorr Clarifiers for sedimentation of raw sewage, and the addition of three Dorr Digesters for sludge digestion. Hawley & Freese, Cons. Engrs.

A good time to Remodel Sewage Treatment Plants

IN the past few years there have been rapid advances in sewage treatment methods and equipment. This timely period for public work construction offers an excellent opportunity for modernizing existing plants.

Possibly the installation of a Dorr Detritor for continuous grit removal may be all that is needed at one plant. At another, a Dorrco Bar Screen or Screen Unit will improve plant operation by reducing the solids load to be handled in the sedimentation units. At some plants, Dorr Traction Clarifiers can be fitted into existing sedimentation tanks to provide for continuous sludge removal. The sludge can be sent to a Dorr Digester where the gas can be collected and later used to generate heat.

Improvements such as those suggested above have actually been carried out at many existing plants. Any city which undertakes such work at present is helping the unemployment situation, as well as providing greater health protection for its population. Our engineers will be glad to furnish full details to consulting engineers and municipal officials who are interested in a modernization program.

DORRCO

Ask our nearest office for Bulletin 6001

DENVER, COLO. 1009 17th Street
CHICAGO, ILL. 333 North Michigan Avenue
LOS ANGELES, CAL. 108 West 6th Street
WILKES-BARRE, PA. Miners Bank Building
ATLANTA, GA. 1503 Candler Building
TORONTO, ONT. 330 Bay St.

THE DORR COMPANY

ENGINEERS

247 PARK AVENUE NEW YORK CITY

INVESTIGATION TESTS DESIGN EQUIPMENT

MELBOURNE, AUSTRALIA
Crossle & Duff Pty., Ltd., 360 Collins Street

TOKYO, JAPAN
Andrews & George Co., Inc., Central P. O. Box F-23

LONDON
The Dorr Company, Ltd. Abford House, Wilton Rd., S. W. 1

BERLIN
Dorr Gesellschaft m. b. H. Kielganstr, 1 W. 62

PARIS
Societe Dorr et Cie 26 Rue de la Pepiniere

JOHANNESBURG, S. A.
E. L. Bateman Locarno House

The *classified* INDUSTRIAL LITERATURE section is your guide to the latest catalogs—see page 93

LOWER THE COST OF STREET WORK WITH STORM SEWERS OF . . .

ARMCO *Corrugated Iron* PIPE

Under this street in Elyria, Ohio, a storm sewer of Armco Corrugated Iron was installed in 1907. In 1921—14 years later—when the pavement was replaced, the Armco Corrugated Pipe was inspected, found in good condition, and left in to serve through the future years. It is in service today.

Their 24 year SERVICE RECORD *stands alone!*

STREET officials, engineers and contractors from coast to coast have found that storm sewers of Armco Corrugated Iron Pipe help them save money . . . by postponing the day of costly sewer replacements and street repairs. Witness Elyria, Ohio, where Armco Corrugated Pipe served without interruption for 14 years, outliving the pavement . . . and was left in for more years of service when the street was repaved! Such facts of performance, being common with Armco, are *absolutely convincing* that this champion product is the one to use. Officials, engineers and contractors know they can depend on the storm sewer whose quarter-century record of service to date is unequalled by any other product of its type on the market today.

But Armco Corrugated Iron Pipe, they know also, is more than a durable, low-cost-per-year product. Being light, easy to haul and to install, and requiring less excavation, Armco Storm Sewers save money at the very start.

Moreover, Armco Corrugated Pipe is backed by the largest group of drainage specialists in existence. Hundreds of Armco engineers in the field bring the results of their studies, experience and investigations of storm sewers to "Headquarters" library. This library of facts is for your use, and contains data that may aid in lowering the cost of your storm sewer work. Without obligating yourself in any way, mail the coupon. Address the Association or the member nearest you.

ARMCO CULVERT MANUFACTURERS ASSOCIATION, *Middletown, Ohio*

Armco culverts and drains are manufactured from the Armco Ingot Iron of The American Rolling Mill Company and always bear its brand.

Gentlemen: Please send data on storm sewers of Armco Corrugated Iron Pipe.
I am ☐ an Official ☐ Engineer ☐ Contractor
I am especially interested in----------
[redacted] ----------
[redacted] ----------

© 1930, A.C.M.A.

PW12

ENGINEERS *knew it was right*

2,000,000 feet of Erosion-Resistant

ARMCO *Paved Invert* PIPE

now in use . . and the demand grows

Under highway and street alike, wherever erosion stalks, Armco Paved Invert Pipe serves successfully. The scene, with its projecting Paved Invert Pipe, shows a bend in the road between Elk Park and Boone, Watauga County, N. C.

FOUR years ago Armco Paved Invert Pipe was introduced. It was presented to the drainage engineering world as a forward step in the fight against erosion, enemy of all drainage structures in direct contact with hydraulic traffic.

"Give Armco Corrugated Iron Pipe that one quality which all drain pipe lacks—the ability to 'stand up' against the steady attacks of sand, silt, stones and boulders," said prominent authorities, "and the superiority of Armco Corrugated Pipe will again have been established over all comers." Armco research and "in the ground" tests resulted in adoption of a bituminous pavement for the invert of the pipe.

More than a protective coating—a floor of tough, resilient material which fortifies against wear where wear comes—in the invert.

Engineers everywhere *knew* it was right. Their analyses said so. This paving, they said, will not only effectively protect the base metal against erosion; it will increase the life of the structure and decrease its cost per year.

That was four years ago. Today, more than 2,000,000 feet of Armco Paved Invert Pipe are in use, attesting the confidence of foremost engineers and proving the true worth of the paved invert principle and application. *The bituminous pavement has weathered four years of service in "Nature's laboratory" under almost every condition of water flow, without perceptible show of wear!*

Its success has created a large and growing demand for Armco Paved Invert Pipe. Obtain factual field data on this cost-saving product by checking and mailing the coupon—over.

ARMCO CULVERT MANUFACTURERS ASSOCIATION, *Middletown, Ohio*

INDUSTRIAL LITERATURE

Describing Materials and Equipment for Constructing, Operating and Maintaining Public Improvements

You can obtain the catalogs listed on this and the following pages by using the form at the bottom of this page or by writing to the Company direct, giving the catalog number and mentioning PUBLIC WORKS.

Construction Methods and Equipment

Accessories, Motor Truck

1. Truck accessories—winches, power take-offs, derricks, special bodies, earth boring machines, and trailers of all capacities are described in a series of folders issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Air Compressors

2. Portable Air Compressors. Complete data regarding Ingersoll-Rand, gasoline or electric drive, portable air compressors is given in Publication 3615. These are made in six sizes and are suitable for rubber or steel tire, skid or trailer mounting, Ingersoll-Rand Co., 11 Broadway, N. Y.

Asphalt Heaters

8. A 54-page booklet issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illutsrates oil, wood and coal burning asphalt and tar kettles, tool heaters, sand dryers, tool boxes, traffic line markers, grout mixers, asphalt tools and their use in road construction.

9. "Hotstuf," the master oil burning heater, is the only heater with patented elevated melting chamber for Asphalt, Tar and all bitumens used in road and street construction and maintenance, roofing, water proofing, pipe coating, etc. Described in illustrated manual No. 11—Mohawk Asphalt Heater Co., 94 Weaver St., Schnectady, N. Y.

Asphalt Plants

10. J. D. Farasey Mfg. Company, Cleveland, Ohio, issue a booklet for use and specifications for Farasey Portable Asphalt Paving Plants. These R. R. 1-car plants have easy capacity of 2,250 yards, 2" surface per 8 hours. Cheap to operate.

Asphalt Rollers

12. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Issued by the Erie Machine Shops, Erie, Pa.

Breakers, Pavement

17. Ingersoll-Rand Paving Breakers which are made in two sizes, are designed for tearing up pavements and hard surfaces and are also used on all kinds of demolition. Full data in bulletin 4164.

Chip Spreaders

25. The Universal Road Machinery, Company of Kingston, N. Y., have issued a booklet describing their Reliance Chip Spreader, a special trailer, operating in the reverse direction, designed for resurfacing bituminous highways. Spreads to a width of 8' to any desired thickness.

Concrete Accelerators

29. "Curing Concrete with 3C Brand Calcium Chloride," a 20 page pocket manual published by the Columbia Products Company, Barberton, Ohio. A handy, concise, practical reference work; contains tables and illustrations.

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully the subjects suggested by its title. A well-illustrated and instructive volume.

31. "Curing Concrete Roads with Solvay Calcium Chloride," 30 page booklet. Comprehensive. Contains tables, illustrations, suggestions for testing devices. Covers the subject in considerable detail. Published by the Solvay Sales Corp., 61 Broadway, New York, N. Y.

Concrete Curing

34. "Concrete—Its Manufacture and Use," a complete treatise and handbook on present methods of preparing and handling portland cement concrete. National Equipment Corp., Milwaukee, Wis. *Koehring Division.*

Concrete Mixer

41. Booklet illustrating features and use of the 27E Heavy Duty paving mixer for concrete highway and pavement construction. National Equipment Corp., Milwaukee, Wis. *Koehring Division.*

43. Koehring "Dandie" concrete mixers in 5S, 7S and 10Ss size are described fully in new illustrated catalog published by the National Equipment Corp., Milwaukee, Wis. *Koehring Division.*

44. Concrete Mixers. A 32-page booklet published by the Jaeger Machine Co., 400 Dublin Ave., Columbus, Ohio.

Concrete Placing

45. Placing concrete with chutes from steel towers and mast hoist plants is described fully in a 95-page booklet that gives valuable information to the construction man. National Equipment Corp., Milwaukee, Wis. *Insley Division.*

Crushers

57. Up-to-date information on Stone Crushers, Stone Spreaders, Unloaders, Drags and other contractors' equipment from the Galion Iron Works & Mfg Co., Galion, Ohio.

59. A new booklet has just been issued by the Universal Road Machinery Company of Kingston, N. Y., describing their full line of portable and stationary crushing, screening and washing units.

Drills

66. "Jackhammer" Drills are built in six sizes. The 27-lb. BAR-33, is recommended for soft rock, concrete, etc.; the 75½-lb. DDR is recommended for the heaviest and roughest work. Intermediate sizes meet other drilling conditions the world over. Full information on use in bulletin 4146. Ingersoll-Rand Co., 11 Broadway, N. Y.

Dump Wagons, Spring Wind-Up

68. Bulletin W-30-J, just issued by Western Wheeled Scraper Company, Aurora, Illinois, illustrates and explains the new Western Automatic Spring Wind-up with which all Western Crawler Dump wagons, either new or in service, can be equipped without requiring any attachment on the tractor. This device makes the employment of a wagon man unnecessary.

Dump Wagons, Steel

70. Steel Dump Bodies and hydraulic hoists for Fords and other small trucks are described and fully illustrated in technical literature published by the Wood Hydraulic Hoist and Body Co., 7924-60 Riopelle St., Detroit, Mich.

71. "Steel Dump Bodies." Full data on steel dump bodies for every type of hauling proposition and description of special "Self-Dumper Bodies" for road Builders. Wood Hydraulic Hoist and Body Co., 7924-60 Riopelle St., Detroit, Mich.

Grading Machinery

77. Western Wheeled Scraper Company of Aurora, Illinois, has issued a new general catalog, No. 80, and two sectional catalogs, Nos. 81 and 82, devoted to dump cars and grading machinery respectively. The catalogs are profusely illustrated and describe in detail the long line of Western tools and machines.

Hoists

80. "Novo Hoisting Handbook." Gives detailed descriptions of hoisting jobs of every type in every part of the country. Completely illustrated with pictures and diagrams. Novo Engine Co., 244 Porter St., Lansing, Michigan.

Hoists, Truck

85. "Dump Truck Hoist." Double the Truck's value by using power operated Hydraulic Hoists. Catalog of WOOD Hydraulic Hoist and Body Company. Detroit, Michigan, describes Hydraulic Hoists for every make and model of Truck.

Hoppers, Measuring

90. The C. S. Johnson Co., Champaign, Ill., publish a booklet which describes the Johnson Demountable Bins and Measuring Hoppers. Data sent on request.

Hose and Belting

87. Complete information on rubber hose and belting for all types of contracting and road building service available from the Government Sales Department of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Loaders and Unloaders

96. Portable car unloaders save money for the contractor on road and other construction projects. Full information on this and on the Reliance Chip and sand spreader on request. Universal Road Machinery Co., Kingston, N. Y.

Motor Trucks

107. "Trucks for Federal, State, County and City Governments," a booklet issued by Dodge Brothers, division of Chrysler Corporation, gives information about company's trucks in municipal, county, state and government activity.

108. Four-wheel-drive trucks to increase the range of truck operation and

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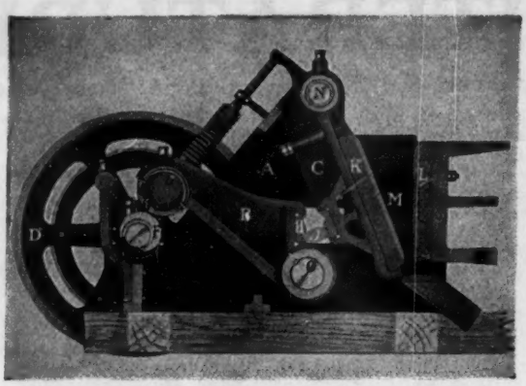

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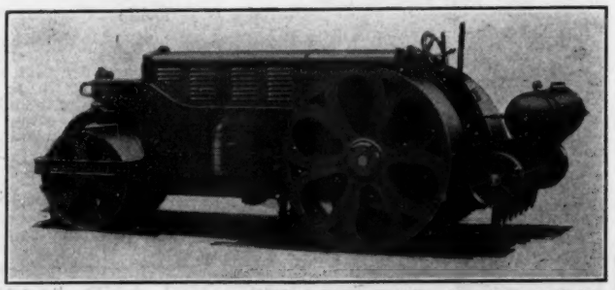

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HUBER 4 CYLINDER MOTOR ROLLER

for economy of operation for use in road building and maintenance, described in a series of new folders just issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Paving Materials

111. "Tarvia Double Seal Pavements." Shows, step by step, the construction of a Tarvia pavement. Profusely illustrated with photographs, 24 pages. The Barrett Company, 40 Rector Street, New York.

Pneumatic Tools

114. Pneumatic Tools—chipping, scaling and calking hammers; clay diggers and picks; riveters, holders-on and jam riveters; drills, including track, close quarter and wood-boring types, portable saws, compressed air motors and motor hoists, sand and backfill rammers. A tool for every requirement. Data Book 8000. Ingersoll-Rand Co., 11 Broadway, N. Y.

Power Graders

117. A large wall display piece, No. 3001, printed in three colors and containing a very large illustration of the Warco Model "E" power grader as well as complete descriptions on both center and rear control graders will be sent by the W. A. Riddell Co., of Bucyrus, Ohio, to anyone interested.

Pumps, Contractors'

119. 'Domestic' Contractors' Pumps. Automatic Priming, Ball Bearing Centifugals 2½" to 6" sizes. 'Giant' Road Pumps, 80 and 100 gallons per minute. Dependable Diaphragm and Plunger Trench Pumps and Hoists. Special Bulletins. Domestic Engine & Pump Co., Shippensburg, Pa."

122. Humdinger contractors' pumps. Diaphragm pumps in both the open discharge and the diaphragm force pump types. Self-priming Centrifugal pump, for automatic continuous prime on suction lifts up to 28'. Are described fully and valuable practical information for contractors is given in special Bulletins #107-A and 1034. Ralph B. Carter Co., 53 Park Place, New York, N. Y.

Road Construction

123. "Road Construction and Maintenance" are covered in a new Cletrac Booklet, which takes up such subjects as modern methods of handling large capacity equipment, tandem equipment, etc. Cleveland Tractor Co., 1932 Euclid Ave., Cleveland, Ohio.

Road Rollers, Scrapers, Graders, etc.

127. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Issued by the Erie Machine Shops, Erie, Pa.

128. A beautiful 32 page book in four colors featuring their entire line of road rollers has been published by the Buffalo-Springfield Roller Co. of Springfield, Ohio. 8¾ x 11, leatherette cover, numerous action pictures.

131. 20-page pocket size booklet showing all types of Buffalo-Springfield motor rollers and scarifiers. The Buffalo-Springfield Roller Company, Springfield, Ohio.

132. "Road Machinery." A sixty-four page data book has been issued by the Austin-Western Road Machinery Company, 400 No. Michigan Ave., Chicago, describing their full line of road building machinery. Included in it are illustrations and descriptions of road graders, 5-foot blade to 12-foot blade; road rollers, steam or gasoline powered, 3 to 15-tons single cylinder to four cylinder. Motor graders, three sizes. Scarifiers. Crushing plant equipment, small road tools. Special bulletins on each separate piece of machinery supplement the general catalog.

133. "Road Rollers." New illustrated booklets covering the entire line of Master 4-Cylinder motor roller, 4-cylinder tandem roller and International motor roller. Galion Iron Works and Manufacturing Co., Galion, O.

134. 36-page, illustrated book describing mechanical features of Huber 4-cylinder Motor Roller and its application to many types of road construction and maintenance. Huber Mfg. Company, Marion, Ohio.

135. Road Machinery Illustrated. New illustrated bulletins on the master Motor Roller, Three-Wheel and Tandem Rollers, Motor Graders powered by Caterpillar, Twin City, Cletrac, McCormick-Deering and Fordson tractors, and Straight and Leaning Wheel Graders. Galion Iron Works & Mfg. Co., Galion, O.

136. Full description of Huber Motor Rollers in sizes from 5 to 15 tons, included in durable 36-page book for use by road contractors and maintenance crews. Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

137. The Autograder, Dreadnought and Motorgrader are described and illustrated in 2 colors in three bulletins just published by the Good Roads Machinery Co., Kennett Square, Pa

Shovels, Cranes and Excavators

142. The Cranemobile, "successor to Trench Cranes," an adaptation of the crawler mounted Bay City Tractor Shovel is fully described and illustrated in Bulletin C2 just issued by Bay City Shovels, Inc., Bay City, Mich.

145. Catalog K3 just issued, completely describes the light half yard and the full half yard convertible shovel, crane, dragline, trench hoe and skimmer manufactured by Bay City Shovels, Inc., Bay City, Mich. 28 pages, over 50 illustrations, action pictures and charts.

146. Portable gas unit excavators, concrete construction and contractors' equipment. Special booklets. National Equipment Corp., Insley Div., Milwaukee, Wis.

147. Complete specification catalogs on the Koehring No. 301, 401 and 501 gasoline or electric shovels, cranes and draglines. National Equipment Corp., Milwaukee, Wis. *Koehring Division.*

151. The complete line of ½-yd. to 1½-yd. shovels, cranes, draglines, ditchers and skimmers manufactured by the Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill., is described in Bulletin 60, which also gives lifting capacities and working ranges for the different sizes and types of these crawling tread machines.

Steel Forms

155. A well illustrated catalog of Steel Forms for concrete road, curb and sidewalk construction is available from The Heltzel Steel Form & Iron Company, Warren, O.

Steel Bins

159. Steel bins and measuring hoppers are included in a fully illustrated catalog of Contractors Equipment issued by The Heltzel Steel Form & Iron Company, Warren, Ohio. Write for your copy.

Steel Posts

160. Steel Posts for all purposes. Sweet's Herculean Steel Posts for highway guard rails, fences and other purposes. Catalog and data book. Sweet's Steel Company, Williamsport, Pa.

Steel Towers

163. "Steel Towers," a 95-page book of information for those interested in placing concrete "Steel Masts," a 16-page booklet is also interesting and valuable. National Equipment Corp., Milwaukee, Wis. *Insley Divison.*

Tires, Truck and Car

165. Solid, cushion and pneumatic tires and tubes for trucks, cars, tractors, graders and other road machinery. Full information and data available from Government Sales Department of the Goodyear Tire & Rubber Company, Inc., Akron, Ohio.

Tool Trailer

167. Mohawk Hi-Speed Tool Trailer—a rugged tool box 7' long 3' wide, 2' high with sliding tray made of 10, 12 and 14 gauge steel, mounted on two rubber tired wheels. Drop the tools in, lock it, and hook it to a truck and your tools are there when you want them. Write for circular. Mohawk Asphalt Heater Co., 94 Weaver St., Schenectady, N. Y.

Tractors, Crawler

169. Cletrac crawler tractors. Cleveland Tractor Co., 19322 Euclid Ave., Cleveland, O. Bulletin 562 describes their use in roadbuilding and maintenance, earth moving, excavating, grading, snow removal, oil field work and lumbering. Made in "20," "30," and "40" and "100" sizes.

170. "Roads," a series of five fully illustrated folders, prepared by the Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill., shows what Russell graders and "Caterpillar" tractors can do and are doing to build better roads quicker and cheaper.

171. The design, construction, details and complete specifications of the new Ten and Fifteen models "Caterpillar" are given in a booklet recently published by the Caterpillar Tractor Co. of San Leandro, Calif., and Peoria, Ill.

173. Cletrac Crawler Tractors are built in a complete line by The Cleveland Tractor Company, 19322 Euclid Ave., Cleveland, Ohio. Cletracs range in size from the 12 h. p. model to the powerful 100 h. p. tractor.

Tractors, Wheel

175. "Huber Tractors" and "The Huber Motor Rollers." Illustrations of machines in operation and testimonials from users. The Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

176. "Kerosene Power, the Low-Price Road Builder," book of data by the International Harvester Co., 606 So. Michigan Ave., Chicago, shows economy of kerosene tractors. Illustrations, specifications and figures on cost of operation.

Truck Cranes

182. Full-revolving, gasoline-operated Truck Cranes with a capacity of 7½ tons at a 10 ft. radius, for mounting on a 5-ton or 7½ ton auto-truck, are described in Bulletin 62, issued by the Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill.

Truck Hoists

183. "Dump Truck Hoists." Double the Truck's Value by using power operated Hydraulic Hoists. Booklet published by WOOD Hydraulic Hoist and Body Company, 7924 Riopelle St., Detroit, Michigan, describes Hydraulic Hoists for every make and model of Truck.

Wheeled Scoops

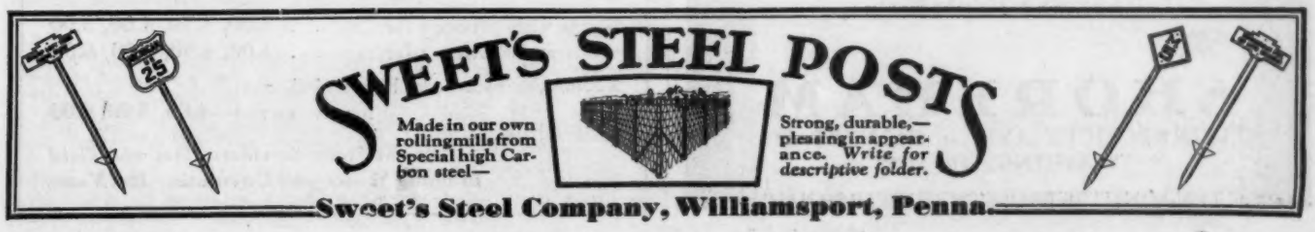
190. The Warco wheeled scoops, claimed to offer the most economical handling of earth on short hauls, is fully described and illustrated in bulletin N. 3002, issued by the W. A. Riddell Co., of Bucyrus, Ohio. Printed in three colors and fully illustrated—will be sent to anyone interested.

Road and Street Maintenance

Asphalt, Heaters

200. For general construction and maintenance, the Original Improved "Hotstuf" Asphalt Heater, an economical oil burning heater. A new bulletin, 4 pages, 6½x 10. The Mohawk Asphalt Heater Company, 94 Weaver St., Schenectady, N. Y.

201. Tar and Asphalt Kettles, Oil Burning Kettles, Pouring Pots, Torches and Hand Spraying Attachments. Full data. Connery & Company, Inc., of Philadelphia.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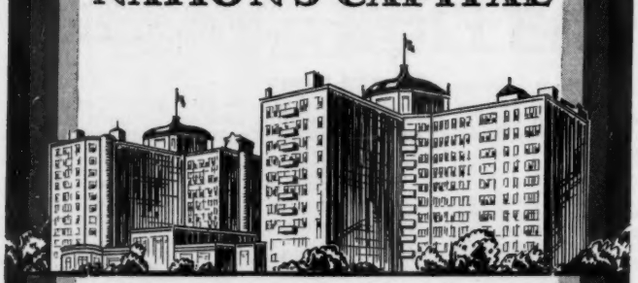

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202. Connery & Company, Inc., 3900 N. Second St., Philadelphia, Pa., has issued a new Bulletin "J" describing the latest and improved style "J" Oil Burning Kettle for Paving Contractors, Street and Highway Departments.

203. A 54-page booklet issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates oil, wood and coal burning asphalt and tar kettles, tool heaters, sand dryers, tool boxes, traffic line markers, grout mixers, asphalt tools, etc.

Bituminous Distributors

205. Complete details regarding performance and construction of the Good Roads Champion Distributor are presented in an attractive book published by the Good Roads Machinery Co., Kennett Square, Pa., 50 pages; 26 illustrations.

Cold Asphalt Equipment

207. Spreaders and other inexpensive maintenance equipment adapted to use BITUMULS described in a 70-page manual on BITUMULS furnished on request by the American Bitumuls Company, 503 Market Street, San Francisco, or 4200 O'Donnell Street, Baltimore.

Dust Control

210. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with dust control, road building and maintenance. It contains tables and composition, grading, etc.

211. "Dust Control," a concise, handy pocket reference on control of dust by use of 3C Calcium Chloride. Illustrated. Issued by the Columbia Products Company, Barberton, Ohio.

Dust Laying

213. Solvay Sales Corporation, New York, supplies full information regarding the use of Solvay Calcium Chloride for effectively laying dust. The booklet, "Solvay Calcium Chloride, a Natural Dust Layer," 24 pages, 5½x8, covers application, economies, etc. Sent without cost.

Equipment

215. "Road and Street Maintenance Equipment," a compact vest pocket manual containing illustrations and brief descriptions of their extensive line, has just been issued by Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

216. "Light and Heavy Road Maintenance" is the title of a recent folder showing the tremendous power developed by the FWD truck and its economy for use in pulling road graders and maintainers—issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Road and Paving Materials

Cold Asphaltic Pavement

225. The construction of Durable and Non-skid asphaltic pavements with cold asphaltic cement described with specifications and tables in a fully illustrated 70-page free hand book on BITUMULS published by the American Bitumuls Company, 503 Market Street, San Francisco, or 4200 O'Donnell Street, Baltimore.

Concrete Curing

235. "How to Cure Concrete," is a manual of instruction on the curing of concrete pavements. A handy, useful volume, well illustrated. 47 pages, 5½x7½. The Dow Chemical Company, Midland, Mich.

Culverts

238. The use and advantages of large diameter pipe culverts in place of small open bridges are described in a 16-page, 6x9, illustrated bulletin, "Applying Culvert Simplicity to Highway Bridge Requirements," by Armco Culvert Mfrs. Association, Middletown, Ohio. Sent on request.

Culverts, Full Circle

239. "Looking into GOHI Culverts," a complete booklet on Gohi corrugated culverts is now ready for distribution. It contains much valuable information regarding Gohi culverts and their installation. Issued by the Gohi Culvert Mfrs., Newport, Ky.

Culverts, Half Round, Flat Bottom

240. Detailed data sheets and circulars on the installation of Gohi half round, flat bottom culverts. Also full information regarding their adaptability for certain uses. Prepared by the Gohi Culvert Mfrs., Newport, Ky.

Culverts, Perforated

241. Complete information concerning the use and adaptability of Gohi perforated culverts is now available. Published by the Gohi Culverts Mfrs., Newport, Ky.

Maintenance Materials

268. Road and street maintenance and reconstruction with BITUMULS Cold Asphaltic Binder described in an illustrated paper by C. H. Thomas, Maintenance Engineer. Reprints furnished by American Bitumuls Company, San Francisco or Baltimore.

270. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with road building, maintenance and dust control. It contains tables of composition, grading, etc.

272. Preservation of Streets and Roads by the use of Road Oil, with many illustrations and testimonials from users. The Standard Oil Co. of Indiana, Chicago.

273. "Stanolind." Stanolind Paving Asphalt, a compound prepared by the Standard Oil Co. of Ind., is described in minute detail in booklet "Stanolind." Standard Oil Co. of Indiana, Chicago.

275. "Tarvia-K. P. for Cold Patching." An instructive booklet illustrating and describing each step in patching a road with "Tarvia-K. P." 16 pages, illustrated, 3½x9. The Barrett Company, New York.

276. "Road Maintenance with Tarvia." A 56-page illustrated booklet of value to every road man. Shows how almost every type of road and pavement can be repaired and maintained with Tarvia. The Barrett Company, New York.

277. "Tarvia." An attractively illustrated 32-page booklet describing grades of Tarvia and showing photographs of actual application. The Barrett Company, 40 Rector St., New York City.

Traffic, Street and Warning Signs

297. Data on "Early" street signs and sign posts. Describes adjustable method of fastening frame to staff, and illustrates porcelain enamel and other plates. Traffic and Street Sign Co., Newark, N. J.

Garbage and Refuse Disposal

305. "Pittsburgh-Des Moines Incinerator," built and guaranteed by the Pittsburgh-Des Moines Steel Company, 79 Neville Island, Pittsburgh, Pa., is described fully in a booklet sent on request.

Snow Removal

Snow Removal

348. "Winter Maintenance" is the title of a recent booklet issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin. Illustrates many types of snow plows and methods of handling snow removal problems.

349. "The Answer to the Snow Removal Problem" is the title of a new booklet just published by Carl Frink, Mfr., of Clayton, N. Y. It gives full details of the new Frink type S snow plow for trucks.

350. The W. A. Riddell Co., successors to Hadfield-Penfield Steel Co., Bucyrus, Ohio, has just issued new literature describing Fordson Snow Removers and Hadfield-Penfield One-Man Graders.

353. Efficient methods of combating quickly the snow menace on highways and city thoroughfares. Illustrates joint use of crawler tractors and standard and special snow plows. The Cleveland Tractor Co., 19322 Euclid Ave., Cleveland, Ohio.

354. "Snow Removal Equipment," a colorful booklet just off the press of the Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill. Various types of snow-fighting equipment built for "Caterpillar" Tractors are pictured in relief and in action.

356. Good Roads Champion Snow Plows are fully described and illustrated in several attractive bulletins just issued by the Good-Roads Machinery Co. of Kennett Square, Pa. Specify whether you are interested in blade or "V" type, for truck or tractor and whether for heavy or light duty.

358. The new Type "S" Frink Sno-Plows and Frink Leveling Wings, together with complete data for selecting the proper size snow plow for your particular make and model of truck. Published by Carl H. Frink, Clayton, N. Y.

359. Galion Iron Works and Mfg. Co., Galion, Ohio, will gladly furnish details, prices and catalogs of their snow plows adaptable to any make of truck.

Sewerage and Sewage Disposal

Aeration and Diffusion Plates

395. A complete booklet describes Norton Porous plates for activated sludge treatment plants, and for other sewage and water uses; also other shapes of fused alumina. Booklet includes data regarding chemical and physical characteristics, and tables published by Norton Co., Worcester, Mass.

Inlets and Manhole Covers

400. Cast iron sewer blocks, ventilators, manhole covers and inlets, valves, etc., described in pamphlet by the South Bend Foundry Co., South Bend, Ind.

Joints, Sewer Pipe

402. "How to make a perfect cement joint for sewer pipe under all conditions with Weston's Gasket and Form." Illustrated. Recently issued by L. A. Weston, Adams, Mass.

Odor Control

404. For information and booklet on control of odors at sewage treatment plants, write Wallace & Tiernan Co., Inc., Newark, N. J.

Pipe, Vitrified

405. Full information regarding Vitrified Pipe and other heavy clay products. Illustrated price list on application. Factories in Pennsylvania and Ohio. The Progressive Clay Co., offices in New York City, Philadelphia, Pa., and Syracuse, N. Y.

Septic Tanks

411. Septic Tanks made of Copper-Bearing, Rust-Resisting Iron—all seams extra heavy welded, are described and illustrated in a folder published by the manufacturers, Mohawk Asphalt Heater Co., 94 Weaver St., Schenectady, N. Y.

Sewage Screens

414. The Dorr Co., 247 Park Ave., N. Y., publishes Bulletin No. 6391, which describes the construction and operation of the Dorrco Mechanically-Cleaned Bar Screen.

Sludge Bed Glass Covers

418. Sludge Bed Glass Covers—"Super-Frame" Hitchings & Co., Main Office, Elizabeth, New Jersey. Offer A. I. A. File 101SB, Describing glass covers for sludge and sprinkler beds.

Sludge Bed Glass-Overs

421. The use of Lord & Burnham sludge bed Glass-Overs at Dayton, Ohio, are described in Subject No. 10. There are 11 Glass-Overs, each 60 feet wide and 163 feet long, covering 2½ acres. Lord & Burnham Co., Graybar Bldg., New York.

422. The use of Lord & Burnham sludge bed Glass-Overs at the Highland Park, Ill., sewage treatment plant are described in Subject No. 11. This is one of the smaller of the eight sewage treatment plants on the Chicago North Shore. Lord & Burnham, Graybar Bldg., New York.

423. Sludge Glass-Overs at Fostoria, Ohio, are described in Subject No. 14. At this plant the sludge removal carrier is supported directly on the roof construction. Lord & Burnham Co., Graybar Bldg., New York.

424. The Sludge Glass Overs at the Bloomington and Normal, Ill., plant are described in Subject No. 15. The plant serves a population of 54,000. A sludge bed area of 0.774 square feet for maximum estimated population is provided. Lord and Burnham Co., Graybar Bldg., New York.

Treatment

425. Dorr Company, 247 Park Ave., New York, in its Sanitary Engineering bulletin describes the use of its equipment for treating municipal sewage, industrial wastes and water. Photos of numerous operating plants are shown as well as representative flow sheets illustrating the various methods of sewage treatment.

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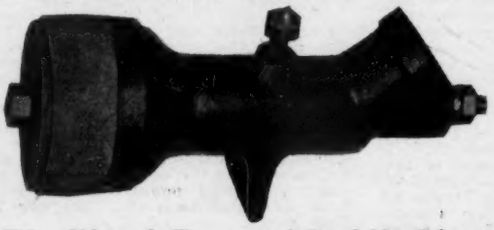

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INDUSTRIAL LITERATURE

of materials and equipment handled by our advertisers can be easily ordered by number from the classified list beginning on page 93.

427. The Pacific Flush Tank Company, of Chicago and New York, publish eight separate catalogs on Sewer and Sewage Disposal Automatic Equipment, including pumps, Imhoff Tanks and Sewer Joint Compounds. These are of real value to the designer or operator of a treatment plant.

428. Advantages of Liquid Chlorine for disinfection given in booklet issued by the Electro Bleaching Gas Co., 9 East 41st St., New York.

429. Chlorine is being extensively used in the disinfection of sewage not only as a disfectant but as an aid to other purification processes. Wallace & Tiernan Co., Inc., Newark, N. J., have a publication, No. 42, on the chlorination of sewage, which will be sent to any address on request.

430. The Dorr Co., 247 Park Ave., N. Y., publishes Bulletin No. 6171, which describes the treatment of sewage with Dorr Traction Clarifier, an improved type of continuous sedimentation for use in water and sewage treatment plants.

432. The Dorr Company, 247 Park Ave., N. Y. C., publishes Bulletin No. 6481, which describes the construction and operation of the Dorr Detritor for continuously removing and washing the grit from sewage flows.

433. A complete booklet describes Norton Porous plates for activated sludge treatment plants, and for other sewage and water uses; also other shapes of fused alumina. Booklet includes data regarding chemical and physical characteristics, and tables published by Norton Co., Worcester, Mass.

434. Automatic, continuous vacuum filters, producing a relatively dry cake of sludge in demand for fertilizer, are used by: Milwaukee, Houston, Chicago, Gastonia, N. C., Charlotte, N. C., write for literature, Oliver United Filters, Inc., Federal Reserve Bank Bldg., San Francisco, Calif.

Water Works Equipment

Aeration and Diffusion Plates

465. A complete booklet describes Norton Porous plates for activated sludge treatment plants, and for other sewage and water uses; also other shapes of fused alumina. Booklet includes data regarding chemical and physical characteristics, and tables published by Norton Co., Worcester, Mass.

Chlorination

470. Chlorine and Chemicals for purification of water and disinfection of sewage with description of Pennsylvania Salt Manufacturing Company's facilities for supplying these cheaply. Booklet, 15 pages, 3½x6. Widener Building, Philadelphia.

471. Wallace & Tiernan Co., Inc., Newark, N. J., have just published a new technical publication, No. 74, describing chlorine control apparatus for the sterilization of the water supplies of small communities. Copy will be sent on request.

Couplings and Tees

485. Copper pipe for water works services and patented connections for jointing to corporation stops, iron pipe, etc. Full data 22 pages 8½ x 11. The Mueller Co., Decatur, Ill.

Gate Valves

490. Double disc, fully bronze mounted Columbian Gate Valves are fully described and illustrated in a 6-page bulletin issued by the Columbian Iron Works, Chattanooga, Tenn.

Hydrants

504. Fire hydrants, modern and improved are illustrated and described in a two color folder recently issued by the Columbian Iron Works, Chattanooga, Tenn.

505. "Mathews" Fire Hydrants. Gate Valves and other water works appurtenances. 16 pages, 7¾x10¾. R. D. Wood & Co., Philadelphia.

506. Hydrants, tapping apparatus, gate locks, valves and curb cocks described in a series of bulletins issued by A. P. Smith Mfg. Co., East Orange, N. J.

Hydrant Extensions

510. Hydrant extension sections for use in Columbian hydrants already installed are briefly described in a handy folder issued by the Columbian Iron Works of Chattanooga, Tenn.

Meter Boxes

525. Efficient installation and maintenance of water meters is described in catalog issued by H. W. Clark Company, Mattoon, Ill., manufacturers of Meter Boxes, Coupling Yokes, Meter Testers, Service and Valve Boxes.

526. An illustrated catalog covering meter boxes and specialties such as gate valve housing, curb boxes, meter testers, melting furnaces, jointing materials, four-in-one pumps, has recently been published by the Hydraulic Equipment Co., Reading, Pa.

Pipe, Cast Iron

534. "Sand-Spun," Centrifugal cast iron pipe manufactured by R. D. Wood & Co., Philadelphia, is fully described in a valuable 16-page 6x9 booklet, containing also complete specifications of this pipe. No engineer or water works official should be without this booklet.

535. Cast Iron Pipe and Fittings, sizes 1¼ through 12 inches, either with or without Precaulked lead joints factory-made in the bells. Data book sent free. The McWane Cast Iron Pipe Co., Birmingham, Ala, and Provo, Utah.

536. "Weights and dimensions of Cast Iron Pipe and Fittings." A handy reference book for Municipalities and Contractors. 48 pages, 7¾x10¾. R. D. Wood & Co., Philadelphia.

537. "Uinversal Cast Iron Pipe," for water supply, fire protection and sewage disposal. All jointing materials eliminated. Machined iron-to-iron joints made with wrenches only. (Booklet). The Central Foundry Company, 420 Lexington Ave., New York, N. Y.

538. "High Pressure Fire Protection Lines." Booklet containing excerpts from Underwriters report on Universal Cast Iron Pipe. The Central Foundry Company, 420 Lexington Ave., New York, N. Y.

539. U. S. Cast Iron Pipe Handbook contains useful tables and data for the Water Works man on pipe line construction. Issued by U. S. Cast Iron Pipe and Foundry Company, Burlington, N. J.

Pipe, Cement Lined

540. Steel or Wrought Iron Pipe lined with cement and special lead-lined joints, manufactured by the Cement Lined Pipe Co., of Lynn, Mass.

Pumps, Deep Well

565. A new type of centrifugal pump is described in an illustrated booklet just published by Layne & Bowler, Inc., of Memphis, Tenn.

Pump Packing

575. "When Power Is Down," by the Sterling Engine Company, Buffalo, N. Y., gives recommendations of models for standby services for all power requirements.

Service Boxes

578. "Service Boxes with Stay-on Covers. No more broken covers. No more lost covers." (Booklet). The Central Foundry Company, 120 Lexington Avenue, New York, N. Y.

Storm Sewers

579. A valuable 24-page, 6x9 illustrated bulletin for city engineers and officials, entitled "Planning Municipal Drainage for Today and Tomorrow," has been published by Armco Culvert Mfrs. Association, Middletown, Ohio. Sent to anyone interested free on request.

Swimming Pools

580. Wallace & Tiernan Co., Inc., Newark, N. J., have just published a new edition of technical publication, No. 41, dealing with the sterilization of swimming pools by liquid chlorine. Copy sent on request.

Tanks and Stand Pipes

582. A 50-page booklet issued by Pittsburgh Des Moines Steel Co., 79 Neville Island, Pittsburgh, Pa., on complete water works plants, elevated tanks, stand pipes and filtration plants built by them.

Tapping and Valve Machines

583. The A. P. Smith Company, of East Orange, N. J., furnish descriptive matter dealing with their many labor saving devices as the Smith tapping machine, valve inserting machine and pipe cutting machines.

Valve Boxes

590. "Standard," "Special" and "Type K" Valve boxes are all described and illustrated in a new bulletin recently published by the Columbian Iron Works, Chattanooga, Tenn.

Miscellaneous

Airport Construction

597. "Getting on the Air Map With 'Caterpillar'," profusely illustrated with action pictures, describes the many uses of the tractor in building and maintaining airports better, quicker, cheaper. Caterpillar Traction Co., San Leandro, Calif., and Peoria, Ill.

Asphalt Construction

605. Methods of mixing BITUMULS Cold Asphaltic Cement with natural soil or gravel for inexpensive landing areas and of constructing BITUMULS (cold) penetrated runways described in construction reports furnished by the American Bitumuls Company, 503 Market Street, San Francisco.

Community Advertising

610. Booklet showing various forms of publicity matter useful in arousing interest in the construction of small town water supplies. This matter is furnished free to Consulting Engineers and towns interested in waterworks construction by The Cast Iron Pipe Research Association, 566 Peoples Gas Bldg., Chicago, Ill.

Rules

625. The Lufkin Rule Company, Saginaw, Mich.; New York; Windsor, Canada. Manufacturers of Measuring Tapes, Boxwood Rules, Spring Joint Rules, Straight and Folding Steel Rules, Fine Mechanics Tools and Aluminum Folding Rules. General Catalog No. 11.

Sanitary Engineering

627. A Review of Sanitary Engineering Progress in 1929 listing here. Reprint from an article in Public Works showing the progress in Water Supply and Purification, Sewerage, Sewage Treatment, and Refuse Collection and Disposal, and listing important projects under way. Box 423, Grand Central Station, New York City, N. Y.

Tree Moving

632. "Tree Moving," folder from the Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill., shows and tells with action pictures and the letters of landscaping experts how to successfully move large trees.

New Catalogs

Not described before in the Industrial Literature Section.

56. Pioneer Gravel Equipment Manufacturing Company, Minneapolis, Minnesota, publishes complete 80-page manual, showing blue print sketches of set-ups in pit or quarry of the eleven different sizes of Pioneer Crushing Plants.

Drag Lines

61. Write for complete catalog on Pioneer Drag Line. Catalog shows cross section of Drum Unit with full description of Frame, Sheaves, Motor and Bucket.—Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

Hoppers, Measuring

86. The C. S. Johnson Co., Champaign, Ill., publish a booklet which describes the Johnson Demountable Bins and Measuring Hoppers. Data sent on request.

Lanterns and Torches

90. Send for interesting catalog in colors of Dietz Lanterns and Road Torches adapted for night traffic warning on any construction work that obstructs the highways. R. E. Dietz Co., 60 Laight St., New York, N. Y.

Loaders and Unloaders

97. Link-Belt Company, Philadelphia, describes a line of Portable Loaders and Unloaders in Folders: Nos. 1073 and 1074 cover Belt Conveyors with channel iron

and truss types of framework; No. 1076, Portable Bucket Elevators for different classes of work; and No. 1149, the "Grizzly" Crawler Loader for heavy work and large capacities.

Plows

112. Plows, Grade Rippers (Scarifiers) and Scrapers are fully illustrated in a new catalogue which will be sent upon request by Wiard Plow Company, Batavia, N. Y. Oldest Plow manufacturers in America.

Scrapers

125. Plows, Grade Rippers (Scarifiers) and Scrapers are fully illustrated in a new catalogue which will be sent upon request by Wiard Plow Company, Batavia, N. Y. Oldest Plow manufacturers in America.

Sand and Gravel Washing Plants

139. Up to date information on Portable Sand and Gravel Washing Plants with concrete capacities, ranging from 30 to 100 yards per hour.—Pioneer Gravel Equipment Mfg. Co.. Minneapolis, Minn.

Screens

140. Full information concerning Shaker and Revolving Screens, Conveyors, Elevators, Bins and Chutes is contained in catalog and special illustrated folders on Pioneer line. Write Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

Cranes, Shovels-Draglines

141. Link-Belt Company, Chicago, in Book 1095, gives valuable information on Heavy Duty Crawler Cranes-Shovels-Draglines, ¾ to 2½-yard capacity, with full line of attachments—grab buckets, trench hoes, dippers, magnets, hook blocks, back-filler boards, grapples, pile drivers, etc.; also complete line of Locomotive Cranes and accessories.

Culverts, Large Diameter

237. The advantages of pipe culverts over open type bridges, and the latest approved practice of including detour, maintenance and operating costs in the total cost of a road or bridge project, are explained in the 16-page illustrated bulletin, "Applying Culvert Simplicity to Highway Bridge Requirements," issued by the Armco Culvert Mfrs. Association, Middletown, Ohio. Write for a copy of Bulletin H-31.

Culverts, Cost Comparisons

328. A 24-page illustrated booklet, "Selecting Culverts and Drains on the Basis of Cost per Year," reviewing the factors which, collectively considered, permit true cost comparisons between structures serving the same purpose, has been published by the Armco Culvert Mfrs. Association, Middletown, Ohio. Bulletin H-34 will be sent free on request. Write for it today.

Jointing Materials

401. G-K Compound for vitrified clay sewers, MINERALEAD for bell and spigot water mains, also M-D Cut-Ins for making house connections, described in catalogue of Atlas Mineral Products Company, Mertztown, Pennsylvania.

Sewage Screens

415. Link-Belt Company, Philadelphia, shows in Book 642 its line of sewage screens (Tark, Brunotte, and Straightline) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit; and Mechanical Aerators for activated sludge plants.

Pipe for Subdrainage

549. A revised 16-page well illustrated bulletin, "Increasing the Efficiency of Roadbed Drainage," containing information on the newest developments in the application of subdrainage to highway, municipal and public works construction —including frost boil prevention, landslide control and airport drainage. Ask for Bulletin H-30. Armco Culvert Mfrs. Association, Middletown, Ohio.

Airport Drainage

598. "Building Safety Into Airports—with Efficient Drainage Construction," a 24-page well illustrated booklet outlining the requirements for airport drainage has been published by the Armco Culvert Mfrs. Association, Middletown, Ohio. A copy will be sent to those interested free on request. Ask for Bulletin C-2.

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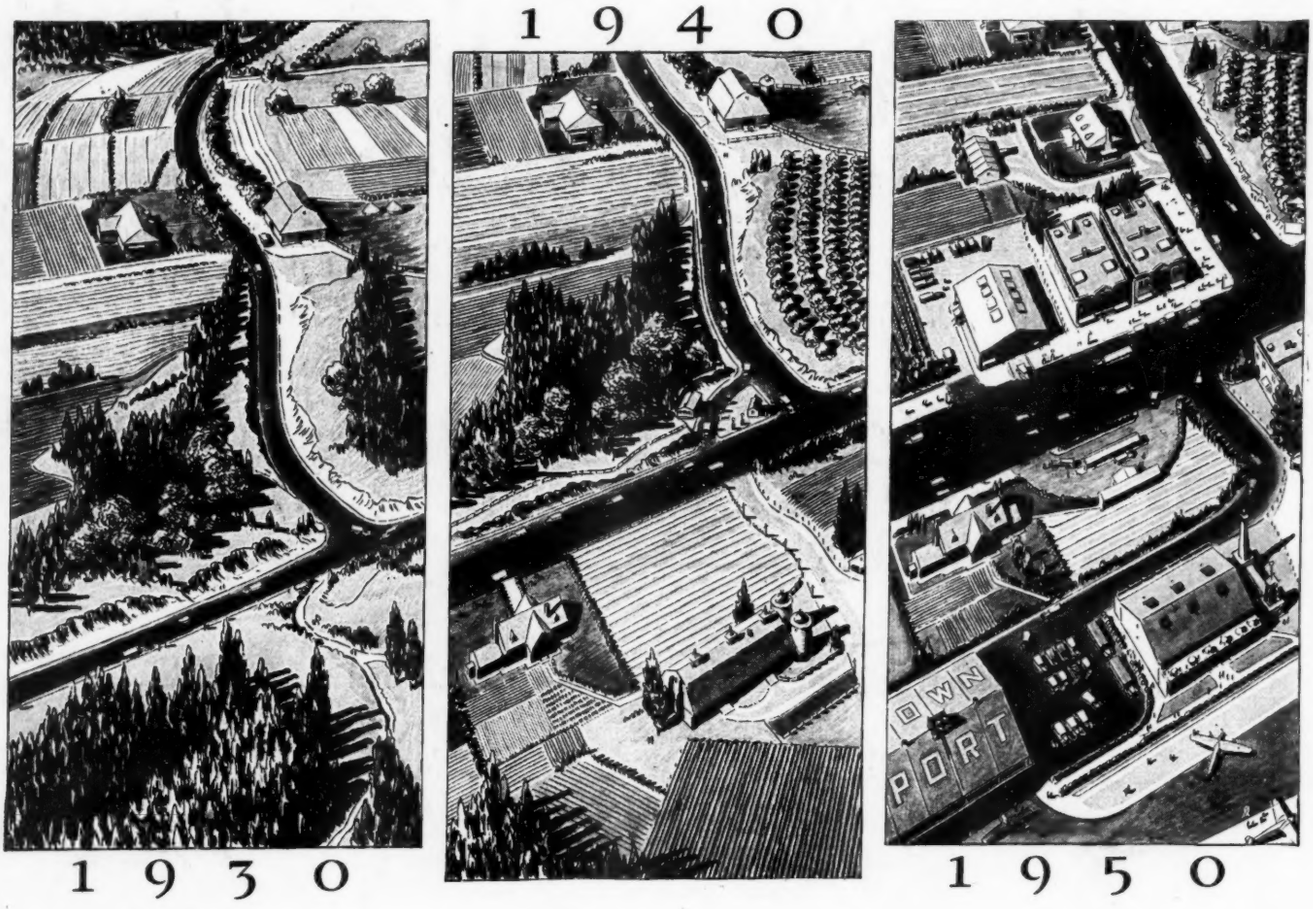

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